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OP 1664 (Vol. 1)

U.S. EXPLOSIVE ORDNANCE

28 MAY 1947

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NAVY DEPARTMENT
BUREAU OF ORDNANCE
WASHINGTON 25, D. C.

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ORDNANCE PAMPHLET 1664

UNITED STATES EXPLOSIVE ORDNANCE

1. Ordnance Pamphlet 1664 describes and illustrates United States Navy projectiles, Army and Navy rockets, pyrotechnics, grenades, land mines, bombs, and guided missiles.

2. This publication contains information on the characteristics of construction and operation of value to the student of ordnance.

3. This publication supersedes the handbooks on American explosive ordnance published by the U. S. Navy Bomb Disposal School, all copies of which shall be destroyed in accordance with applicable security regulations.

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G. F. Hussey Jr.

G. F. HUSSEY, JR.,
Vice Admiral, U.S. Navy,
Chief of the Bureau of Ordnance.

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Inserted 11 May 1954 [initials]

NAVY DEPARTMENT
BUREAU OF ORDNANCE
WASHINGTON 25, D. C.

To all holders of ORDNANCE PAMPHLET 1664 (VOLUME 2) insert change; write on cover 'Change 1 inserted'
Approved by The Chief of the Bureau of Ordnance

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9 February 1954

[signature]
Assistant Director, Research & Development Division

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ORDNANCE PAMPHLET 1664 (VOLUME 2) is changed as follows:

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1. Page 302, Column 2:	Change heading "Offensive Mk IIIA1 and Mk IIIA2; also Fuzes M6 and M205" to read "Offensive Mk IIIA1 and Mk IIIA2; also Fuzes M6 and M206A1."
Under same heading, line 5:	Change "M205" to read "M206A1."
Under "Description" second paragraph, line 5:	Change "M205" to read "M206A1."
2. Page 305, Column 1:	Change heading "Gas CN-DM-M6, CN-M7, and CN-M7A1; also Fuze M200A1" to read "Gas CN-DM-M6, CN-M7, and CN-M7A1; also Fuze M201A1."
Under same heading, line 9:	Change "Fuze . . . . . .M200A1" to read "Fuze . . . . .M201A1."
Under "Description" second paragraph, first line:	Change "M200A1" to read "M201A1."
line 3:	Delete "Detonating" and insert "Igniting."
3. Page 310, Column 1, last paragraph, line 5:	Change "Fuze . . . . . .M206" to read "Fuze . . . .M205 or M10A3."
Column 2, first paragraph, line 3:	Change "Fuze M206" to read "Fuze M205 or M10A3."

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4. After the above deletions and insertions have been made, insert this CHANGE sheet in the front of the book, between the front cover and title page.

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GENERAL INTRODUCTION

Scope

This publication is a revision and compilation of the handbooks on American explosive ordnance published during World War II by the U.S. Navy Bomb Disposal School. With some exceptions, it should serve as an encyclopedia of U.S. explosive and pyrotechnic ordnance as of February 1946.

Included are: U.S. guided missiles, bombs, rockets, land mines, grenades, pyrotechnics, and Navy projectiles. Not covered are: Army artillery ammunition, demolition explosives and equipment, underwater or floating ordnance, small arms ammunition, or catapult charges, etc.

Such characteristics of construction and operation as are significant to the ordnance student receive thorough treatment. Other technical details are omitted.

Most of the items are grouped according to size; but, where this is impracticable, numerical or type arrangement is employed.

To make the publication more serviceable for peacetime use, practice items are included in their appropriate sections.

Status

Ordnance included was that classified as service, together with some obsolete, obsolescent, and experimental types. The experimental items were those being actively developed in the spring of 1946, with the probability that they would soon be standardized.

Obsolete and obsolescent equipment described was that which might still be in existence in depots or dumps at the time of writing.

Nomenclature

When a Navy ordnance item is approved for testing, it is assigned its Mark number. It retains this Mark number whether finally approved for service use or rejected. Modifications to the original Mark design are treated likewise. Army items under development are assigned "T" numbers. If the item is standardized by the Army's Ordnance Technical Committee, the "T" designation is dropped and an "M" number is assigned. When a modification on a "T" item is made, the change is given an "E" number: for instance, "T1E1". If the modification is adopted as a standard item, the modification gets an "A" number in sequence of change on the standard item: for instance, "M66A1, M66A2". The Army's Chemical Warfare Service uses "E" and "R" designations for experimental items instead of the "T" and "E" numbers, respectively, of the Ordnance Department. For aircraft ordnance there are items which are standardized for both the Navy and the Army. These are given the letters "AN" before their original standard name; thus, AN–Mk 33 or AN–M63A2.

Prior to June 1925, the Army's nomenclature for bombs was by a Mark and a Roman numeral, like the early Naval Mark designations, but the modifications were distinguished by the letter "M" and another Roman numeral (Mk I M II) where the Navy used the abbreviation "Mod", (Mk 1 Mod 2). In 1925, the Army adopted the "M" system. The Army-Navy Standardization Board was created in June, 1941.

American high explosives

Two scales are employed to compare sensitivity of explosives. The first of these is the "Laboratory Impact Sensitivity" in which the ratio of the drop of a given weight necessary to detonate the explosive under discussion to the drop necessary to detonate TNT, is expressed on a percentage basis. TNT will be given as 100. The second is a scale of "Bullet Impact Sensitivity" with RDX rated at 0 and TNT at 100. The other explosives are expressed in relation to these two. Velocity of detonation

varies directly with the density to which the explosive is cast or pressed, all other factors being constant. The velocity of detonation will, therefore, be given for a definite density of loading.

TNT (Trinitrotoluol): TNT is powerful, brisant, easy to load by casting since its melting point (Grade A) is 80.2 degrees C., stable under all stowage conditions, insensitive enough to stand all normal handling, and even capable of standing bullet impact when cast. The Navy uses it as a booster in a pressed granular form in which it is more sensitive to detonator action.

The velocity of detonation is 22,300 ft./sec. at a density of 1.55. Its Laboratory Impact Value is 100. Its Bullet Impact Value is 100. Its color is yellow to buff.

Tetryl (Trinitrophenylmethylnitramine): Tetryl, because of its combination of high power, brisance, and sensitivity, is the standard U. S. booster charge, although the Navy still uses an appreciable amount of granular TNT. It has been tried for main charge loads in small caliber projectiles, but has proved too sensitive to withstand the setback in all but 20-mm. It is used as a base charge in compound detonators. This, in effect, makes it a small booster in intimate contact with the initiating explosive. The melting point of Tetryl (130 degrees C.) is too high to allow it to be melted and cast. It is loaded by being mixed with small quantities of graphite or stearic acid which serve to lubricate it while it is being pressed into pellets. Tetryl is quite safe to handle and is extremely stable in stowage. Exposed or loose Tetryl should not be handled, as it may cause dermatitis.

The velocity of detonation is 24,400 ft./sec. at a density of 1.55. Its color is light yellow, but it is usually gray because of the graphite. It is more powerful than TNT. Its Laboratory Impact Value is 45. Its Bullet Impact Value is 61.

Explosive D (Ammonium Picrate): Explosive D is the standard main charge for armor-piercing bombs and projectiles and other Navy projectiles. While its power and brisance are slightly inferior to TNT, it is much more insensitive to shock and will stand impact on armor plate without being deflagrated. It has two other disadvantages: (1) Its melting point is too high for it to be melted and cast, and it is therefore loaded by being pressed into cases by a hydraulic ram; (2) It reacts with metals to form extremely sensitive compounds. This is counteracted by covering the interior of bombs or projectiles with acid-proof lacquer.

Its rate of detonation is 21,300 ft./sec. at a density of 1.48. Its power and brisance are about 95% those of TNT. Its Laboratory Impact Value is 99; its Bullet Impact Value is over 100. Its color is yellow or yellow-orange.

RDX (Cyclonite Cyclotrimethylenetrinitramine): RDX is the most powerful and brisant of the military high explosives, and it is considered much too sensitive to use alone. It seems to be about half way between Tetryl and PETN in sensitivity. RDX is being used extensively in mixtures of other explosives and inerts which reduce the sensitivity to a safe range, while the mixtures have a very high brisance and power due to the RDX. It has excellent stowage qualities, but, because of its sensitivity, it is shipped immersed in water like an initiating explosive. The velocity of detonation is 28,000 ft./sec. at a density of 1.70. Its Laboratory Impact Value is 34. Its Bullet Impact Value is 0. Its color is white.

PETN (Pentaerythritetetranitrate): PETN resembles RDX in its characteristics. It is somewhat more sensitive, but almost equal in power and brisance. It is appreciably more sensitive to percussion and impact than Tetryl and is, therefore, not used alone as a booster, though it is being used as a base charge in some compound detonators in the way Tetryl is. The tendency of PETN to burn is much less than that of similar explosives. Its main use alone in the service is in primacord. When used alone, PETN is combined with a small quantity of wax to desensitize and lubricate it, and is loaded by pressing. It is important to know that PETN in primacord is very insensitive to flame, shock, and friction, and therefore must be detonated by a cap.

The velocity of detonation of PETN is 26,000 ft./sec. The velocity of detonation of primacord is 20,500 ft./sec. Its Laboratory Impact Value is 22. Its Bullet Impact Value, though not given, would be about equal to RDX (0). Its color is white.

Haleite (EDNA, Ethylenedinitramine): Haleite is a new explosive that probably will not be used alone, but will be used in combination with other explosives. It is somewhat more powerful than TNT. Its sensitivity is about the same as Tetryl. It melts at 180 degrees C., but one report states that it may detonate in the manner of an initiating explosive at that temperature or a little lower. If loaded alone, it would be pressed. Its rate of detonation is 25,000 ft./sec. at a density of 1.5. Its Laboratory Impact Value is 46. Its Bullet Impact Value is not available.

Nitroguanidine: Nitroguanidine is the explosive incorporated in the Navy's new double-based propellant powder, SPCG. It is unusual in being a high explosive that is so cool in its reaction that it explodes without flash. It is comparable in strength to TNT, and its sensitivity is of the same order. Its rate of detonation is 24,400 ft./sec. at a density of 150.

Amatol: Amatol, a substitute for TNT, is a mixture of ammonium nitrate and TNT; the percentage of ammonium nitrate, depending upon the availability of TNT, has varied from 40% to 80%. Its power and brisance decrease with the increasing percentages of nitrate, and its sensitivity decreases at the same time. However, it is still a fairly good high explosive, even when the TNT is reduced to 20%. 80/20 cannot be cast, since it is not fluid enough to pour even when TNT is molten, and it therefore must be loaded by extrusion. Amatol has a disadvantage in that it is very hygroscopic and therefore is usually protected by a sealing pour of pure TNT.

The velocity of detonation of 50/50 is 19,700 ft./sec. at a density of 1.54. Its Laboratory Impact Value is 93. Its Bullet Impact Value is about 100. Its color is buff.

Composition B: Composition B is intended to be used as a more powerful replacement for TNT in the loading of some of the large size G.P. bombs, and in fragmentation bombs. It will be used where an explosive with more power and brisance is of tactical advantage and there is no objection to a slight increase of sensitivity.

Composition B1 is a mixture of 59% RDX, 40% TNT, and 1% wax. Composition B2 is a mixture of 60% RDX, 40% TNT. The TNT cuts down the sensitivity of the RDX to a safe range and lowers the melting point to 81 degrees C., allowing the material to be cast-loaded.

Composition B might be detonated at low order by bullet impact, but it is almost as insensitive as TNT in this respect. It has an extremely high shaped-charge efficiency. Its velocity of detonation is 24,500 ft./sec. at a density of 1.60. Its total energy of blast in air is about 116% of that of TNT. Its Laboratory Impact Value is 79. Its Bullet Impact Value is 79. Its color is yellow to brown.

Torpex: Torpex is one of the explosives developed during this war to be used mainly in underwater ordnance. The original Torpex (Torpex 1) was a mixture of 45% RDX, 37% TNT, 18% Aluminum powder (1% wax added). Torpex 2, which is now being used, is 42% RDX, 40% TNT, 18% Aluminum powder (1% wax added). It is used in mines, torpedo war heads, and depth bombs. Torpex is more sensitive than TNT; its bullet impact and drop test sensitivities are of the same order as those of Tetryl. It is quite stable in stowage, though it produces gas, causing pressure in the case. It is insensitive enough to stand all normal handling. Its melting point is low enough for it to be cast-loaded. Its velocity of detonation is 24,000 ft./sec. at a density of 1.72. It is 141% as powerful as TNT. Its Laboratory Impact Value is 53. Its Bullet Impact Value is 48. Its color is slate gray.

DBX (Depth Bomb Explosive): DBX is another aluminized RDX mixture, and its name

suggests its intended use. It is 21% RDX, 21% Aluminum Nitrate, 40% TNT, 18% Aluminum. It was designed to replace Torpex, which it closely resembles in sensitivity, strength, brisance, and energy of shock in water, but half of the strategic RDX in Torpex is replaced by Ammonium Nitrate in DBX. It will probably not be used, as the present supply of RDX seems adequate to meet the demand. DBX can be cast, though its melting range of 98–105 degrees C. is about the upper limit. Its velocity of detonation is 22,300 ft./sec. at a density of 1.68. It is 143% as powerful as TNT under water. Its Laboratory Impact Value is not given. Its Bullet Impact Value is 51. Its color is gray.

HBX: HBX is a new mixture designed to replace Torpex in depth bombs. It has been loaded in the Flat Nose Bomb AN–Mk 54 Mod 1. HBX is 40% RDX, 38% TNT, 17% Aluminum powder, 5% desensitizer. Tests indicate that it will be about 98% to 100% as powerful as Torpex, that it will definitely be less sensitive than Torpex in both Laboratory Impact and Bullet Impact, that it will be slightly more sensitive in these respects than TNT, and that it will be about the same order as Composition B.

A difficulty with Torpex and HBX is that they produce gas and build up pressure in the case during stowage. It has been discovered that 0.5% by weight of calcium chloride added to the mixture will absorb all the moisture and eliminate the production of gas. It has been recommended that this percentage be added and that the resulting mixtures be designated Torpex 3 and HBX 1.

Composition A: Composition A is a mixture of 91% RDX and 9% plasticizing oil. The oil content is sufficient to desensitize the mixture and lubricate it enough to allow it to be pressed into A.A. shells, which will probably be its principal use. It is less sensitive than TNT in both drop and bullet impact tests. It is appreciably more brisant and powerful, as is indicated by its velocity of detonation of 27,000 ft./sec. at a density of 1.62. Its Laboratory Impact Value is 105. Its Bullet Impact Value is over 100. Its color may be white or buff, depending upon the color of the oil.

Tetrytol: Tetrytol is a mixture of Tetryl and TNT (70/30 is a frequent ratio.) It is designed to obtain a Tetryl booster that may be cast. This mixture is slightly less powerful and less sensitive than Tetryl. Its particular use is in burster tubes for chemical bombs, in demolition blocks, and in cast shaped charges. It cannot be used where the loaded item is immersed in hot explosive, as are the auxiliary boosters in the loading of Army bombs, because it will be remelted by the heat and separation will result. It is approved for use in all other boosters.

Its velocity of detonation is 24,000 ft./sec. at a density of 1.60. Its Laboratory Impact Value is 45. Its Bullet Impact Value is 65. Its color is yellow.

Pentolite: Pentolite is a mixture of TNT and PETN, usually 50/50. Its chief uses have been in small shell loading, in grenades, and in cast shaped charges. It has a very high shaped-charge efficiency. It is not as stable as TNT in stowage, and separation of PETN may occur. Efforts should be made to keep it cool. Its sensitivity is such that it cannot be drilled, and the fuze cavities in shells that must be drilled are poured with 90/10. It is about the same sensitivity as Tetryl in drop tests, and more sensitive than Torpex to bullet impact. Its brisance and power are equivalent to Composition B. At a density of 1.65, its rate of detonation is 24,000 ft./sec. Its Laboratory Impact Value is 47. Its Bullet Impact Value is 48.

Ednatol: Ednatol is a mixture of 57% EDNA and 43% TNT, designed to ease the shortage of RDX. In the near future, it will be loaded as a substitute for Composition B in large G.P. bombs and fragmentation bombs. It is somewhat more powerful than TNT and comparable in sensitivity. It becomes soft enough to pour at 80 degrees C. and it is, therefore, cast. It is entirely stable in stowage. At a density of 1.60, it has a velocity of detonation of 24,300 ft./sec. Its Laboratory Impact Value is not given. Its Bullet Impact Value is 83. Its color is yellow.

PTX–1: PTX–1 is a new ternary explosive that is undergoing tests and may be adopted for loading in shells, bombs, grenades, mines, demolition blocks, and shaped charges. It is a mixture of 30% RDX, 50% Tetryl, and 20% TNT. This mixture gives a very high explosive equal to Composition B and Pentolite, and superior to Tetrytol and Ednatol. It is less sensitive than Tetrytol and more stable. Its velocity of detonation is 24,200 ft./sec. at a density of 1.66. Its Laboratory Impact Value is 40 (estimated). Its Bullet Impact Value is not given. Its color is yellow.

PTX–2: PTX–2 is another ternary explosive mixture undergoing study for possible future use. It consists of 43.2% RDX, 28% PETN, 28.8% TNT. It is slightly more sensitive in drop and bullet impact tests than Composition B, but a little less sensitive than Pentolite. It is more brisant than any of the binary mixtures now used, which would include Composition B, and is about 10% more effective than Tetryl as a booster. It may be used as a booster, as a main charge for fragmentation ammunition, and as a shaped charge. Its melting point is such that it will be cast. Its velocity of detonation is 26,200 ft./sec. at a density of 1.69. Its Laboratory Impact Value is 50 (estimated). Its Bullet Impact Value is not given. Its color is yellow.

Composition C: Composition C–3 is the only one of the Composition C series now in production, though quantities of the others may be found in the field. It is 77% RDX, 3% Tetryl, 4% TNT, 1% Nitrocellulose, 5% MNT (Mononitrotoluol), 10% DNT (Dinitrotoluol). The last two, while they are explosives, are oily liquids and plasticize the mixture. The essential difference between Compostion C–3 and Composition C–2 is the substitution of 3% Tetryl for 3% RDX, which improves the plastic qualities. Composition C–1 was 88.3% RDX and 11.7% plasticizing oil. The changes have been made in order to obtain a plastic composition that would meet the requirements of an ideal explosive for molded and shaped charges and that would maintain its plasticity over a wide range of temperature and not exude oil.

Composition C–3 is about 1.35 times as powerful as TNT. Its velocity of detonation is 26,000 ft./sec. at a density of 1.58. The Laboratory Impact Value is 98. Its Bullet Impact Value is over 100. Its color is brown.

PEP–3: This is a new plastic explosive being tested for future use. PEP–3 is a mixture of 86% PETN and 14% plasticizing oil. PEP–2 was 85% PETN and 15% oil, but it was a little too soft. PEP–3 is about 90% as powerful and brisant as Composition C, but its stowage stability and plastic range are much better. Its sensitivity is about the same as Composition C, though it has much less tendency to burn.

Picratol: Picratol is a mixture of 52% Explosive D and 48% TNT. It is currently used in the 2000-lb. S.A.P. Bomb M103 and is under consideration for appliance in other Army A.P.'s and S.A.P.'s. Picratol's stability is about equal to that of Explosive D and TNT. It has a rate of detonation of 22,875 ft./sec. at a normal loading density of 1.625. Brisance tests, peak pressure tests, and impulse tests indicate that Picratol's destructive force is somewhat less than that of TNT, but greater than that of Explosive D.

Cyclotol 70/30: Cyclotol 70/30, a mixture of 70% RDX and 30% TNT, closely resembles Composition B except for the altered proportions of the components, and is designed as a replacement for Pentolite. It will not, however, have Pentolite's resistance to flame. Though results of tests are not available, Cyclotol may be anticipated to be more sensitive than Composition B, but considerably less than Pentolite.

Tritonal: Tritonal is composed of 80% TNT and 20% Aluminum powder and is contemplated for use in some 4000-lb. Light-Case Bombs AN–M56, in the JB–2, and in several G.P. bombs (Army 500- and 1000-lb. G.P.'s), where maximum blast effect is desired. Tritonal is cast, segregation of the aluminum being prevented by a pellet loading technique. The Laboratory Impact Value is 89; Bullet Impact Value is 64; and velocity of detonation is 18,000 ft./sec. at a density of 1.70.

Mercury Fulminate: Mercury Fulminate is an initiating explosive that may be used as either a primer or a detonator. It may be detonated by flame, friction, or percussion, and in turn detonate a booster; or it may be mixed with other materials to form a primer composition and used to ignite a propellent charge. Its melting point is much too high for it to be cast, and it is loaded by being pressed into caps. It has one disadvantage for military use in that it will decompose in stowage at tropical temperatures and at the end of about three years may be rendered useless. Compared to high explosives, it has lower power and brisance, a fact which is indicated by its velocity of detonation of 16,500 ft./sec. at a density of 4.00. Its Laboratory Impact Value is 8. Its color is light yellow.

Lead Azide: Lead Azide may be used where a detonation is caused from flame, but Mercury Fulminate is generally preferred where the cap is to be set off by a firing pin. It does have a distinct advantage over Mercury Fulminate in being completely stable in stowage at elevated temperatures. Its rate of detonation is of the same order as Fulminate, 17,500 ft./sec. at a density of 4.00. Its Laboratory Impact Value is 19. Its color is white.

DDNP: This is an initiating explosive which has been used for some time in commercial detonating caps and is now being used to some extent in military types. It is more insensitive to shock than Mercury Fulminate and Lead Azide, though it may be detonated by a sharp blow. It will, therefore, probably be used only where it will be set off electrically or by miner's safety fuse. It has an advantage in being more powerful than other initiating explosives and being comparable in strength to Tetryl. If unconfined, flame will cause it to flash but will not detonate it. This, combined with its insensitivity to shock, makes it much more safe to handle.

Part I

PROJECTILES, PROPELLANTS, AND PROJECTILE FUZES

Chapter I — PROJECTILES

Section I — INTRODUCTION

Existing types

The following types of projectiles may be encountered at activities in the U.S. Naval Service:

Armor-Piercing: These projectiles are designed to penetrate an equal caliber of Class A armor plate, according to test practice. The characteristics:

Over-all color .... Black
Sizes .... 3", 6", 7", 8", 12", 14", 16"
Explosive filling .... Explosive D
Load factor .... 1.5% to 2.7%
Fuzing ..... Base detonating or base ignition

Since it is desirable to keep the center of gravity of a projectile to the rear of (or in the immediate vicinity of) the center of the form, and as a relatively long ogive is conducive to long range, it has been advantageous to adopt light nose pieces or false ogivals termed windshields. The windshield is made of either forged mild steel, steel stamping, or aluminum. It has no special strength other than to prevent destruction during handling and set-back on firing. Windshields are screwed to the cap and are "set" by a center punch.

The armor-piercing cap is secured to the projectile by peening the skirt of the cap into notches cut into the ogive of the body and by soldering the cap to the body with a special solder of low melting point. Such solder prevents the soldering heat from drawing the temper of the body. Caps are made, in general, of the same kind of steel as are the projectile bodies. The cap acts to break down the initial strength of the armor plate, allowing the nose to reach an already strained surface. It also provides powerful circumferential support to the point and nose as they begin to penetrate the hard face, maintaining the support until they are well into the plate. In addition, the characteristically blunt outline of the cap serves to increase the effective angle of obliquity at which the projectile may hit and still penetrate.

The body is of high-quality alloy steel, carefully forged and heat-treated, since it is the part which does the actual penetration. Between the forward bourrelet and the rotating band or rear bourrelet, the diameter of the body is slightly reduced in order to provide a general clearance from the bore of the gun. The bourrelet is the bearing surface of the projectile and rides on the lands of the rifle. This bearing surface is usually about one-sixth caliber in width, and its surface is generally ground to a fine finish to reduce friction and minimize wear on the lands of the gun. With the major caliber projectiles, it has become standard practice to provide a rear bourrelet or bourrelets in addition to the forward bourrelet. Rear bourrelet or bourrelets will be just before and behind the rotating band, providing better support in the gun and during the moment of ejection at the muzzle.

The rotating band has three primary functions: to seal the bore, to position and center the rear end of the projectile, and to rotate the projectile. A secondary function is to hold the projectile in place during loading and elevating for firing. The rotating band is made of commercially pure copper, or of cupro-nickel alloy

containing 2.5% nickel, or in some cases a gilding metal consisting of 90% copper, 10% zinc. As a general rule, rotating bands are about one-third caliber in width.

The base plug closes off the explosive cavity and holds the base fuze or base fuze adapter. Both the base plug and the base fuze adapter, if used, are sealed in place with a gas seal ring similar to that used on the base fuze.

The base fuze is inserted through the base plug or base fuze adapter and is designed to detonate the projectile after penetration. After insertion, it is closed with a gas check ring of copper and lead put in under hydraulic pressure to prevent the propelling gases from affecting the explosive filling.

Armor-piercing projectiles and common projectiles having a windshield may carry a spotting dye which colors the water on impact in order that observers may spot the fall of shot. The spotting dye in powder form is placed in the windshield before it is screwed on to the nose of the projectile. Water forces through the inlet holes covered by copper covers, dissolves the dye, and forces it out the outlet holes.

Special Common: The term "Special Common" is not an official designation of the Bureau of Ordnance, which places this and all other types of Common projectiles in a single class. The "Special Common" term, however, is widely employed by ordnance activities to describe those Common projectiles which are equipped with both windshields and hoods for windshield attachment.

These projectiles are designed to penetrate approximately one-third to one-half their caliber of armor. These projectiles differ from Armor-Piercing projectiles in that they do not have an armor-piercing cap and have a larger explosive cavity. Characteristics:

Over-all color	Slate gray
Sizes	4″, 5″, 6″, and 8″
Explosive filling	Explosive D
Loading factor	2.1% to 3.99%
Fuzing	Base detonating

Common: These projectiles are designed to penetrate approximately one-third their caliber of armor. They differ from Armor-Piercing and Special Common projectiles in that they have no cap or hood; the windshield threads directly to the body. Also, the explosive cavity is slightly larger. Characteristics:

Over-all color	Slate gray
Sizes	5″, 6″, and 8″
Explosive filling	Explosive D
Load factor	4.4% to 5.4%
Fuzing	Base detonating

Old types: In addition to these Special Common and Common projectiles described above, certain types of old Common projectiles are still in use in the Naval service. These projectiles have neither cap nor windshield, are colored slate over all; are loaded with Explosive D or black powder/TNT mixture. In the latter case, they are fuzed with a base ignition fuze. This latter type is found in the 1-, 3-, and 6-pounder projectiles and in the 3-, 4-, and 5-inch sizes.

High-Capacity: These projectiles are designed to have a minimum wall thickness, and the largest explosive cavity consistent with the force of set-back. They are assembled, generally, with no-delay base fuzes, tracers, steel nose plugs, and auxiliary detonating fuzes. The steel nose plug may be removed and a point detonating or nose time fuze substituted. These projectiles are used for shore bombardment, for antiaircraft guns, and for use against light ships and surface craft. The 3-inch High-Capacity has no base fuze. Characteristics:

Over-all color	Green
Sizes	3″, 4″, 5″, 6″, 8″, 12″, 14″, 16″
Explosive filling	Explosive D except the 3″, which is TNT loaded
Load factor	7.0% to 12.6%
Fuzing	Only variation from the no-delay base fuzes is the Base Detonating Fuze Mk 48, with a 0.01-second delay, currently being assembled in 8″ through 16″ H.C. projectiles for bombardment. In the 12″, 14″, and 16″ H.C. projectile, there is a TNT booster beneath the auxiliary detonating fuze, requiring an additional adapter ring

Antiaircraft Common: These projectiles are similar in construction to H.C. projectiles, except that a nose time or V.T. fuze is always assembled. It can be used for antiaircraft fire or, with the time fuze set on safe, used for bombardment. Characteristics:

Over-all color .... Green
Sizes .... 5-inch only
Explosive filling.... Explosive D or Composition A
Load factor 13%
Fuzing...... Nose time or V.T. fuze. Auxiliary detonating fuze. No-delay base detonating fuze

Antiaircraft: These projectiles vary from Antiaircraft Common in that no base detonating fuze is used. Characteristics:

Over-all color .... Green
Sizes .... 3-inch only
Explosive filling..... Composition A or TNT
Load factor......................... 5.7%
Fuzing .... Nose time fuze, auxiliary dentonating fuze

Illuminating: These projectiles are for illuminating targets by a parachute flare. Characteristics:

Over-all color......... Light blue with two white stars
Sizes .... 3″, 4″, 5″, and 6″
Explosive filling..... Black powder expelling charge
Fuzing .... Nose time fuze only

The illuminating projectile is a thin case with a very small expelling charge just behind the fuze and an interior assembly of a star or candle with a parachute and a very lightly held base plug. Explosion of the expelling charge forces out the base and the interior assembly.

When the nose time fuze functions, it ignites the black powder expelling charge, which in turn ignites the star or candle. The star or candle is a steel container in which is packed under heavy pressure an illuminating compound. The closed end of the star container is attached to the strand wires of a parachute. The parachute is carefully folded, and, with its strand wires, is rolled so that upon expulsion it opens, thereby suspending the candle or star. Because of the high velocity at which the projectile is traveling when ejection takes place, it is necessary to slow down the star-parachute assembly before the parachute becomes fully open. This is done by a center wire, one end of which secures the center of the parachute nearer to the star than when the parachute is in full release and causes the parachute to spill air, thereby preventing too great an initial strain on the parachute. After the star has burned for a few seconds, the end of the center wire is released from its point of attachment in the star can. This permits the parachute to open fully.

Window: Window projectiles are designed to be fired from naval vessels to disrupt enemy radar operations. The projectile may be used to provide a false screen behind which our ships may maneuver or approach undetected, or to provide a false target for enemy radar. The projectile itself consists of an illuminating projectile body fitted with a nose time fuze and an expelling charge of black powder. Ignition of the expelling charge by the fuze discharges a payload of foil strips which form a reflecting cloud for radar beams. Characteristics:

Over-all color .... Aluminum
Sizes .... 5-inch only
Filling .... Foil strips and black powder expelling charge
Fuzing .... Nose time fuze

White Phosphorus (Smoke): Smoke projectiles are designed for shore bombardment purposes to produce a combination of screening, antipersonnel, and slight incendiary effects. These projectiles may also be used at sea to provide a surface screen behind which vessels may maneuver undetected. The projectile consists of an illuminating projectile body, fitted with a nose time fuze or point detonating fuze and a black powder expelling charge. The ignition of the expelling charge by a fuze discharges a number of white phosphorus filled steel tubes which ignite on contact with the air. Characteristics:

Over-all color.................... Blue gray

Sizes ....5-inch only
Filling........White phosphorus and black powder expelling charge
Fuzing...Nose Time or point detonating fuze

V.T.-fuzed projectiles: These projectiles are specially cavitized to receive the long-stemmed V.T. fuzes. They contain no tracer or nose fuze adapter, and no base fuzes are used except with the 6"/47 H.C. Projectile Mk 34. In all others, the base is sealed with a gas-checked base fuze hole plug. Other than V.T. type nose fuzes may not be employed in these projectiles. New V.T. fuzed projectiles are being filled with Composition A. Characteristics:

(with "V.T.-fuzed projectiles")
Color ....Depending on type of projectile that is V.T.-fuzed. But on all new projectiles the letters V.T. are painted on the band showing the explosive filler
Sizes............................3", 5", 6"
Filling ....Composition A is being loaded in the new V.T.-fuzed projectiles

Target projectiles: These projectiles are inexpensive productions, with ballistic traits similar to the A.P. projectiles of their caliber. They are unfuzed and contain no explosive. On some types, a dyé is loaded into the windshield, which on impact with the water is funneled out and spread through the water splash, thus distinguishing the origin of the salvo.

Over-all color ....Red
Sizes..............6", 8", 12", 14", and 16"

Gas: The same type of projectile that is used for the smoke round may be loaded with gas for chemical warfare.

Limited-use types: These are summarized in column 2 of this page.

FIELD AND BOMBARDMENT: These projectiles were designed for field use or shore bombardment. They carry point detonating fuzes.

SHRAPNEL: Shrapnel projectiles contain steel balls which are expelled from a shrapnel case by means of a small charge of explosive, the case remaining intact. These projectiles are obsolescent.

FLAT NOSE: Flat nose projectiles are for use against submarines, and are designed to prevent ricocheting on water impact. These projectiles are obsolescent.

TRACER: These are special projectiles designed solely to leave a visible trace in the daytime. They do not have bursting charges. These are obsolescent.

PROOF SHOT: These are special projectiles designed not to ricochet on water impact and are for use in proving-ground work. It is not contemplated that more of these projectiles will be procured when the present stocks are exhausted.

"POUNDER": These are for Coast Guard guns.

Minor caliber projectiles

20-mm ammunition: Two types of 20-mm weapons are at present in service use in the Navy: the Oerlikon antiaircraft gun and the Hispano-Suiza aircraft gun. These types differ widely in construction and functioning; and it is emphasized that the ammunition, though somewhat similar in external appearance, is not interchangeable.

AMMUNITION FOR OERLIKON GUN: The Oerlikon gun and its ammunition are of naval manufacture and design. The ammunition may be distinguished from that designed for the Hispano-Suiza gun by the reduced diameter of the extractor lip at the base of the cartridge case. For identification of individual types of rounds, the body of the projectile is painted a distinctive color, as follows:

TYPE	FILLING	COLOR
H.E. Mk 3	Tetryl	White
H.E. Mk 3	Pentolite	Yellow
H.E.-I. Mk 3	Tetryl and incendiary mix	Red
H.E.-I. Mk 3	Pentolite and incendiary mix	Light pink

Type	Filling	Color
*H.E.-T. Mks 4 and 7	Tetryl and tracer	Light gray
*H.E.-T. Mks 4 and 7	Pentolite and tracer	Blue
A.P.-T.Mk 9	Tracer	Black
B.L. and P. Mk 3	Inert loaded	Dark green
B.L. and T. Mk 7	Inert load and tracer	Dark green with yellow stripe
Drill	Empty	Seal brown
H.E.-I.-T.		Bright green

*When the projectile is assembled with "Dark Ignition" tracers, a ⅛-inch bright red band will be painted around it midway between the bourrelet and the rotating band.

The Mark and Mod, manufacturer's initials or symbol, and lot number are stamped around the body of the projectile.

ABBREVIATIONS IN MINOR CALIBERS

H.E. — High Explosive
I. — Incendiary
T. — Tracer
B.L. — Blind Loaded
P. — Plugged
S.D. — Self Destructive
D.I. — Dark Ignition

AMMUNITION FOR HISPANO-SUIZA GUN: This gun and its ammunition are Army-designed but have been adopted as Naval equipment with the installation of the gun on Naval planes. The ammunition is distinguished from that designed for the Oerlikon gun by the extractor lip on the base of the cartridge, which is the same diameter as the rest of the case. Two series of ammunition for this gun are in use. The "Old Series" consists of unmatched rounds, some adapted from British prototypes, others designed by the Army. The "New Series" is a set of ballistically matched rounds designed by the Army to supersede those of the "Old Series". For identification of specific rounds, the projectile body is painted a specific color, as follows:

Type	Series	Filling	Color
H.E.-I. Mk 1	Old	Tetryl and Incendiary mix	Body-red Bourrelet-yellow Fuze-brass Marking in black
A.P.-T. M75	Old	Tracer and inert load	Black over all Marking in white
Ball, Mk 1	Old	Inert loaded	Black over all
Dummy Drill	Old	Empty	Zinc coated
H.E.-I. M97	New	Tetryl and incendiary mix	Body-red Bourrelet-yellow Fuze-brass Marking in black
Incendiary, M96	New	Incendiary mix	Body-blue gray Nose-light blue Marking in black
A.P.-T. M95	New	Tracer	Black over all Marking in white
Practice, M99	New	Empty	Black over all Marking in white

1.1"/75 ammunition: The body of these projectiles, now obsolete items, were unpainted except for two dots below the fuze, indicating as follows:

Explosive D — Yellow dot
Tracer — Red dot

A newer color marking was proposed for the 1.1-inch ammunition. Some projectiles may be found painted as shown in column 2:

TYPE	COLOR
H.E.-T.	Light gray with white band
H.E.-T./S.D.	Dark green with white band
B.L. and P.	Red over all
B.L. and T.	Red over all with white band

40-mm ammunition: These projectiles are identified by distinctively colored bodies, as follows:

TYPE	BODY	BAND	TIP	REMARKS
A.P.	Black	Black	Black	Plug in tracer
A.P.-T.	Black	White	Black	
H.E.-P.	Green	Green	Green	Plug in base
H.E.-T./S.D.	Green	White	Green	
H.E./S.D.	Green	Black	Green	Dark tracer
H.E.-I.-T./S.D.	Green	White	Red	
H.E.-I.-P.	Green	Red	Red	Plug in base
H.E.-I./S.D.	Green	Black	Red	Dark tracer
H.E.-I.-T.	Green with Black Band	White	Red	S.D. relay not loaded
B.L. and T.	Red	White	Red	Dummy fuze
B.L. and P.	Red	Red	Red	Dummy fuze and plug in base
H.E.-I.-T. (D.I.)-S.D.	Green	White	Red	Dark ignition tracer

The tracer composition is either a red burning mixture in the tracer — "T" rounds — or a non-luminous burning compound in the "Self Destructive" rounds.

"Dark" and "Dark Ignition Tracer": To eliminate the blinding effect on 40-mm and 20-mm gunners from tracer fire at night and also to make the origin of tracer fire less distinct, these tracers were developed toward the close of the war. The dark ignition tracer is invisible until the projectile is 100 to 400 yards from the gun's muzzle, and then it is visible for the rest of its time of flight. Details of these tracers are described with their appropriate projectile and tracer housing.

Description of explosive payloads

Characteristics of the high explosive fillers follow:

Composition A. This is the newest service explosive load. It has a damage-power factor of gain over Explosive D in the 5-inch A.A. projectile of 1.6 to 2.0, thus greatly increasing the force of the burst. A mixture of 91% RDX and 9% wax, Composition A is press-loaded into projectiles. It is a stable, non-hydroscopic explosive with an ignition temperature of 200° C. Continued exposure to temperature of 135° F or higher may cause some exudation of the wax, but this exudate is not explosive. Compared to Explosive D, this filler has about

the same impact sensitivity, but is more sensitive to mass detonation and armor-piercing ignition.

Explosive D (Ammonium Picrate): Explosive D is the standard main charge for armor piercing-projectiles and all other Navy projectiles over 3-inch caliber. While its power and brisance are slightly inferior to TNT, it is much more insensitive to shock and will stand impact on armor plate without being deflagrated. Its melting point is too high for it is to be melted and cast; it is loaded by being pressed into cases by a hydrolic ram. It reacts with metals to form extremely sensitive compounds. This is counteracted by covering the interior of the projectiles with acid-proof lacquer.

TNT (Trinitrotoluol) is the filler in 3-inch H.C. and A.A. and 40-mm A.A. projectiles. A powerful, brisant explosive, it is easy to load by casting, since its melting point is 80.2° C. It is stable under practically all stowage conditions and should stand even bullet impact when cast.

Tetryl (Trinitrophenylmethylnitramine): Tetryl, because of its combination of high power, brisance, and sensitivity, has been tried for main charge loads in small caliber projectiles but has proved too sensitive to withstand the set-back in all but 20-mm. The melting point of Tetryl, 130° C, is too high to allow it to be melted and cast. It is loaded by being mixed with small quantities of graphite or stearic acid, which serve to lubricate it while it is being pressed into pellets. Tetryl is quite safe to handle and is extremely stable in stowage. Exposed or loose tetryl should not be handled, as it may cause dermatitis.

Pentolite: Pentolite is a mixture of TNT and PETN, usually 50/50. (PETN is similar in characteristics to RDX. Its color is white.) It is not as stable as TNT in stowage, and separation of PETN may occur. Efforts should be made to keep it cool. It is about the same sensitivity as tetryl in drop tests, and more sensitive than Torpex to bullet impact. This explosive filler is now used only in 20-mm loads.

Qualities of High Explosive Fillers

	"A"	"D"	TNT	TETRYL	PENTOLITE
Velocity of detonation at density factor	27,000 f.s. at 1.62	21,300 f.s. at 1.48	22,300 f.s. at 1.55	24,400 f.s. at 1.55	24,000 f.s. at 1.65
Laboratory impact value	105	99	100	45	47
Bullet impact value	100+	100+	100	61	48
Color	White or buff	Yellow or orange	Straw	Light yellow-gray with graphite	Sand

Black Powder: Not a brisant explosive, black powder is mixed with TNT in the 5-inch, 6-inch, and 8-inch common projectiles and in the "pounder" rounds. It is also the expelling charge in illuminating, W.P., and "window" loads. Sensitive to friction, black powder varies in color from brown to black.

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Inert fillers

Blind Loaded and Plugged (B.L. & P.): A projectile may be loaded with sand or other inert material and sealed with a solid base plug, or the tracer hole (fuze hole) in a base plug may be blanked off.

Blind Loaded and Tracer (B.L. & T.): These projectiles have an inert load, but a tracer is inserted in the fuze hole of the base plug.

White phosphorus: An unstable smoke-incendiary agent, white phosphorus ignites when exposed to air and produces dense white smoke. It also has its incendiary, anti-personnel effect.

Gas: The various types of gas fillings are listed under the subject of "Chemical Filler Markings" on pages 15 and 16.

Color and markings of new projectiles 3-inch and larger

Following are the markings called for in the new specifications (See figure 1):

Explosive indicator

Yellow	Explosive D
Grey	Black Powder
Green	TNT
One-half grey and one-half green band	TNT and Black Powder mix
Red	Inert material or empty
Blue	Composition A

Time fuze stripe: Projectiles having a nose time fuze shall have a ¼-inch white stripe painted longitudinally from the stationary lug on the fuze two inches aft.

Body color

Black	A.P.
Slate grey	Common
Green	AA., H.C., and A.A. Common
Light blue with two white stars	Illuminating
Aluminum	Window
White	Schrapnel
Ocean grey	Smoke, Gas, or Incendiary
Red	Target ammunition

V.T. Fuzed: The letters "V.T." ¾-inch high are stenciled just before the rear edge of the paint indicating the burster charge.

Tracer band: A white band with four dots 90° apart indicates the color of the tracer.

Spotting band: The color indicates the color of the spotting charge.

"Window" mark: This consists of a one-inch high "W" on each side, 180° apart, just abaft the forward bourrelet.

Stencilling on body: The following information is stencilled between the rotating band and the forward bourrelet on new projectiles:

Ammunition lot number
Caliber and type of projectile
Mark and Mod of projectile
Type nose fuze (whether M.T.F., P.D.F., V.T.F., Mk 32 and similar types, or Dummy Nose Plug) — Mark and Mod of fuze — Lot number of fuze (for Mk 32 and similar types only)
Mark and Mod of auxiliary detonating fuze
Mark and Mod of base detonating fuze
Mark and Mod of tracer — Color of Tracer
Mark and Mod of guns in which projectile can be used
Mark and Mod of "Window" load

Stamped on rotating band

Mark and Mod of projectile
Size and type of projectile
Lot number and year of specification
Inspector's seal and initials

Sometimes the manufacturer's name is included here.

Stamped on base or on base plug

Mark and Mod, size, and type of projectile
Lot number, year of specification
Inspector's seal and initial
Manufacturer's name

The serial number of the projectile will also be stamped on the base plug on the side of the body, and on the windshield if present.

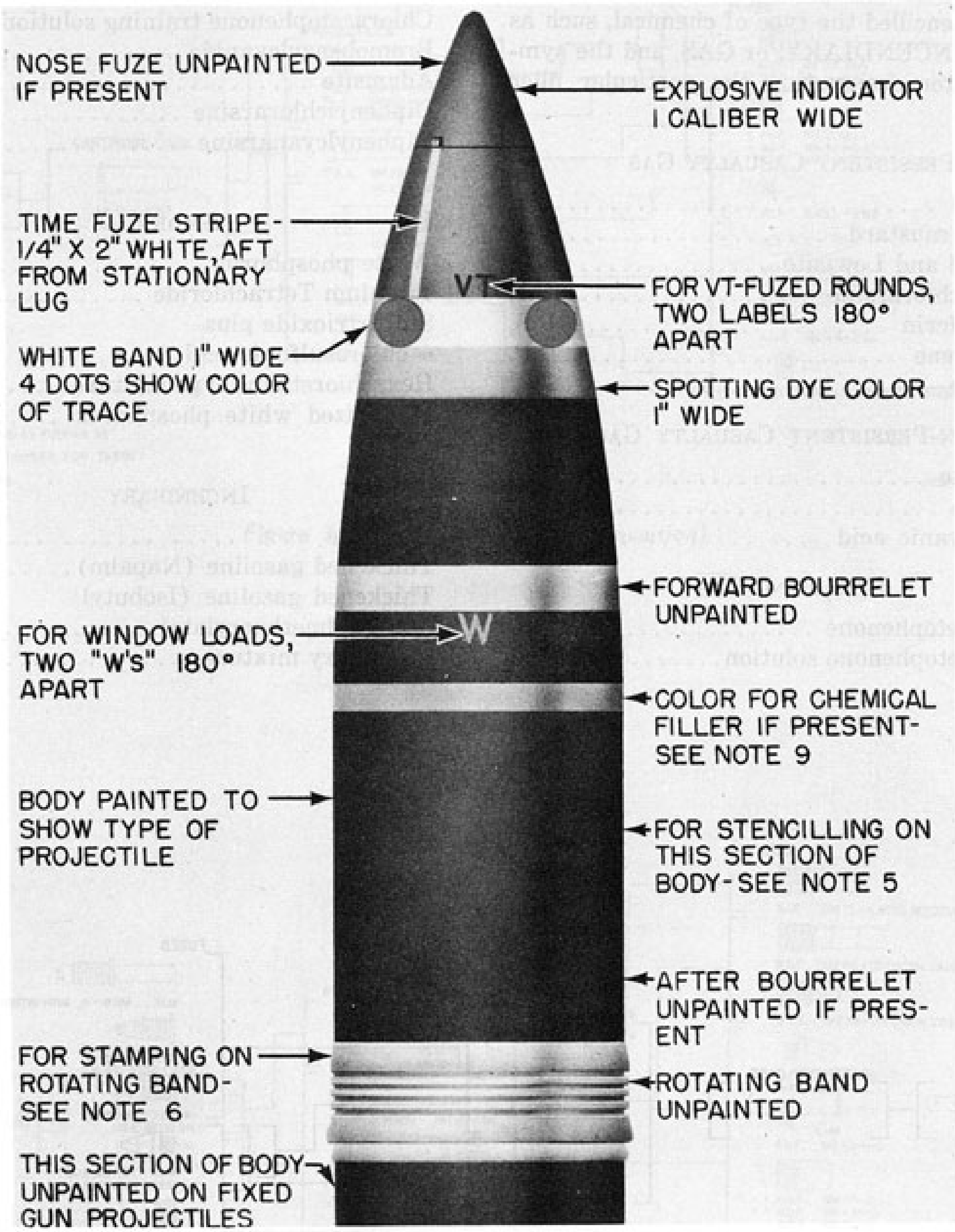


Figure 1. Color and Marking of Projectiles (3-inch and larger)

Chemical Filler Markings

Two green bands ½-inch apart — Persistent casualty gas

One green band — Non-persistent casualty gas

One red band — Harassing gas

One yellow band — Smoke

One purple band — Incendiary

Also, on projectiles having a chemical filler,

there is stencilled the type of chemical, such as SMOKE, INCENDIARY, or GAS, and the symbol or letter designating the particular filler as below:

PERSISTENT CASUALTY GAS

Mustard	H.
Purified mustard	H.D.
Mustard and Lewisite	H.L.
Ethyldichlorarsine	E.D.
Chloropicrin	P.S.
Diphosgene	D.P.
Lewisite	L.

NON-PERSISTENT CASUALTY GAS

Phosgene	C.G.
Chlorine	CL
Hydrocyanic acid	A.C.

HARASSING GAS

Chloracetophenone	C.W.
Chloracetophenone solution	C.N.S.
Chloracetophenone training solution	C.N.B.
Bromobenzylcyanide	B.B.C.
Adamsite	D.M.
Diphenylchlorarsine	D.A.
Diphenylcyanarsine	D.C.

SMOKE

White phosphorus	W.P.
Titanium Tetrachloride	F.M.
Sulfurtrioxide plus chlorosulfonic acid	F.S.
Hexachlorethane type mixture	H.C.
Plasticized white phosphorus	P.W.P.

INCENDIARY

Thermite	T.H.
Thickened gasoline (Napalm)	N.P.
Thickened gasoline (Isobutyl Methylmethacrylate)	I.M.
Incendiary mixture	P.T.

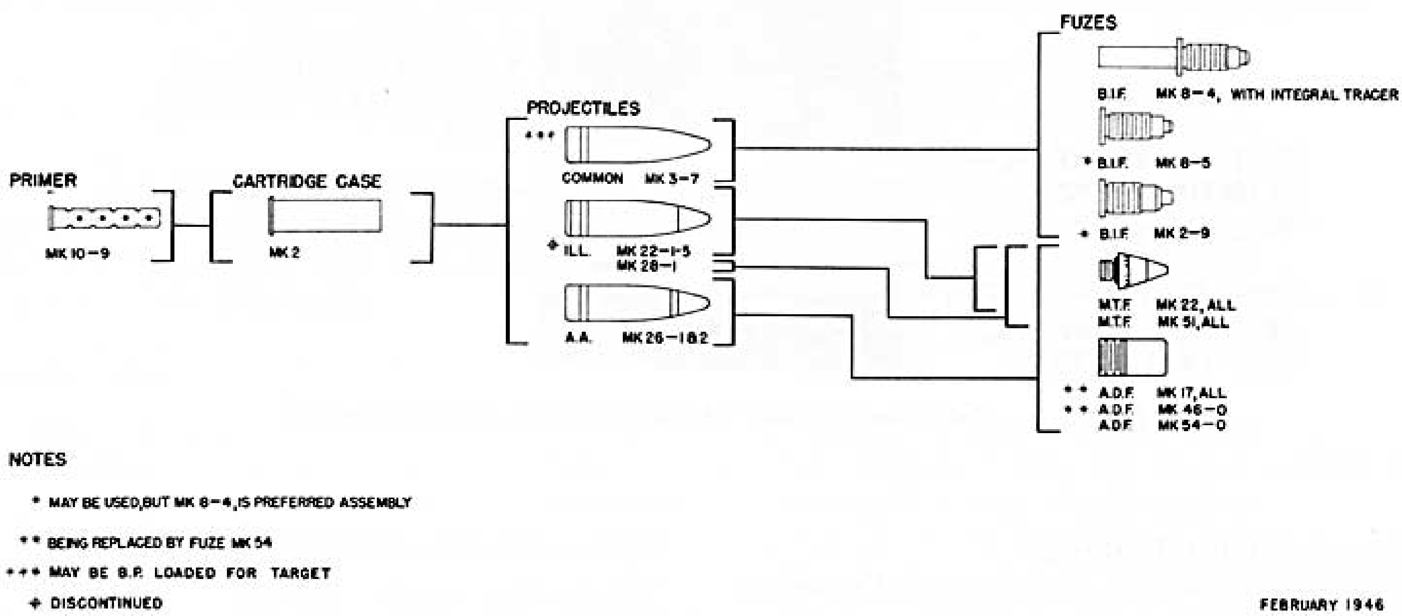


Figure 2. 3"/23 Case Gun (Ammunition)

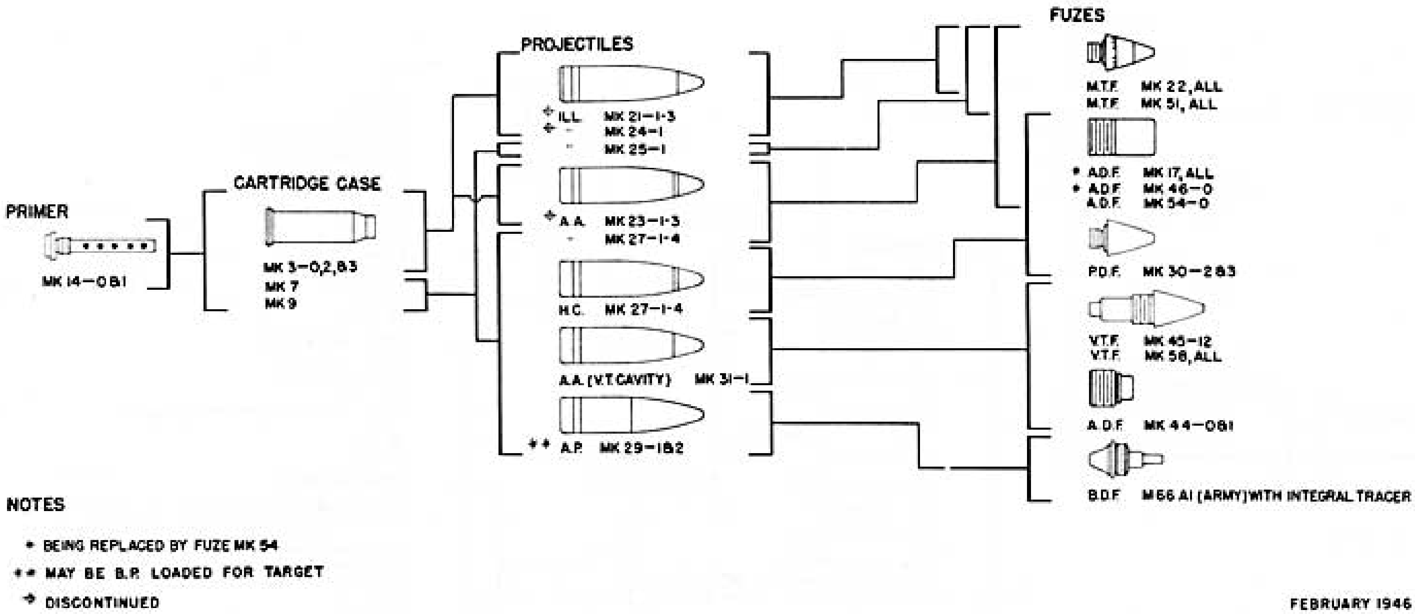


Figure 3. 3"/50 Case Gun (Ammunition)

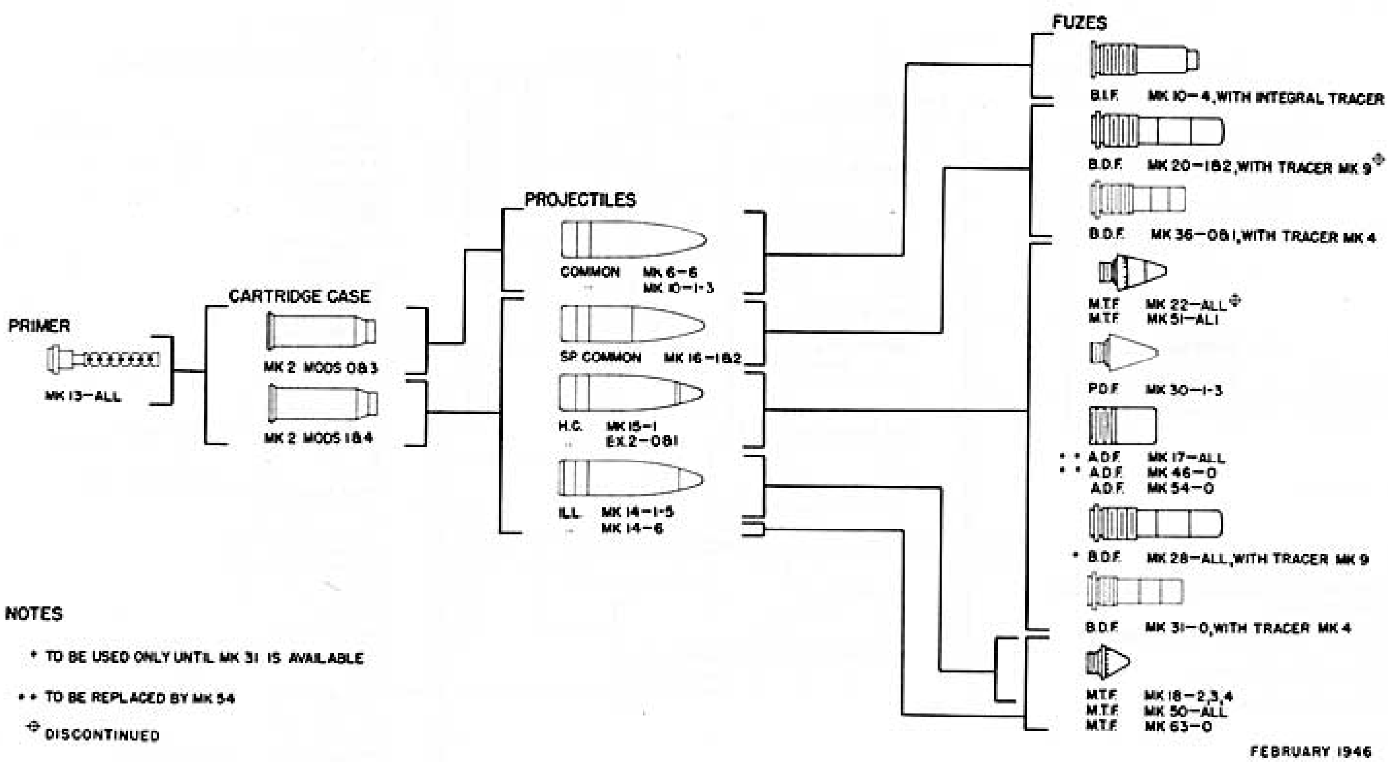


Figure 4. 4"/50 Case Gun (Ammunition)

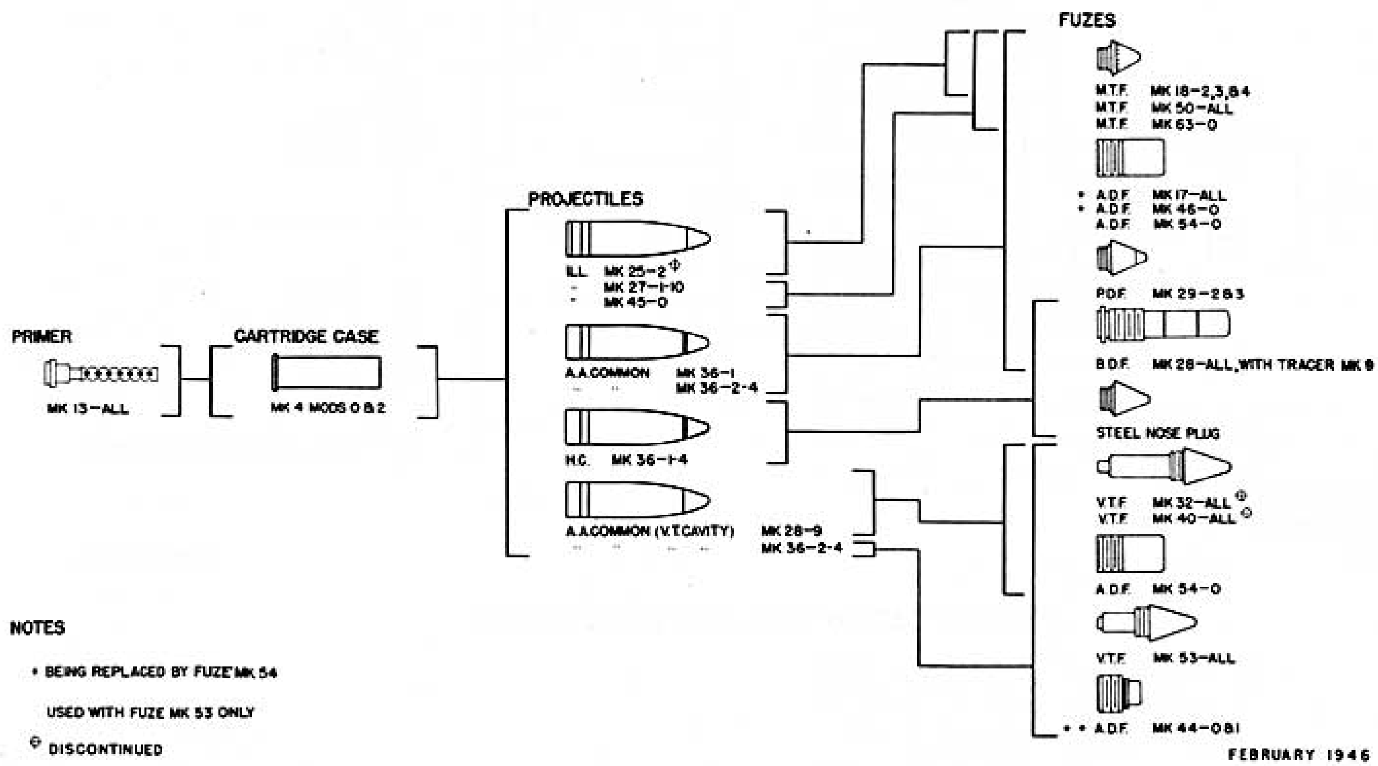


Figure 5. 5"/25 Case Gun (Ammunition)

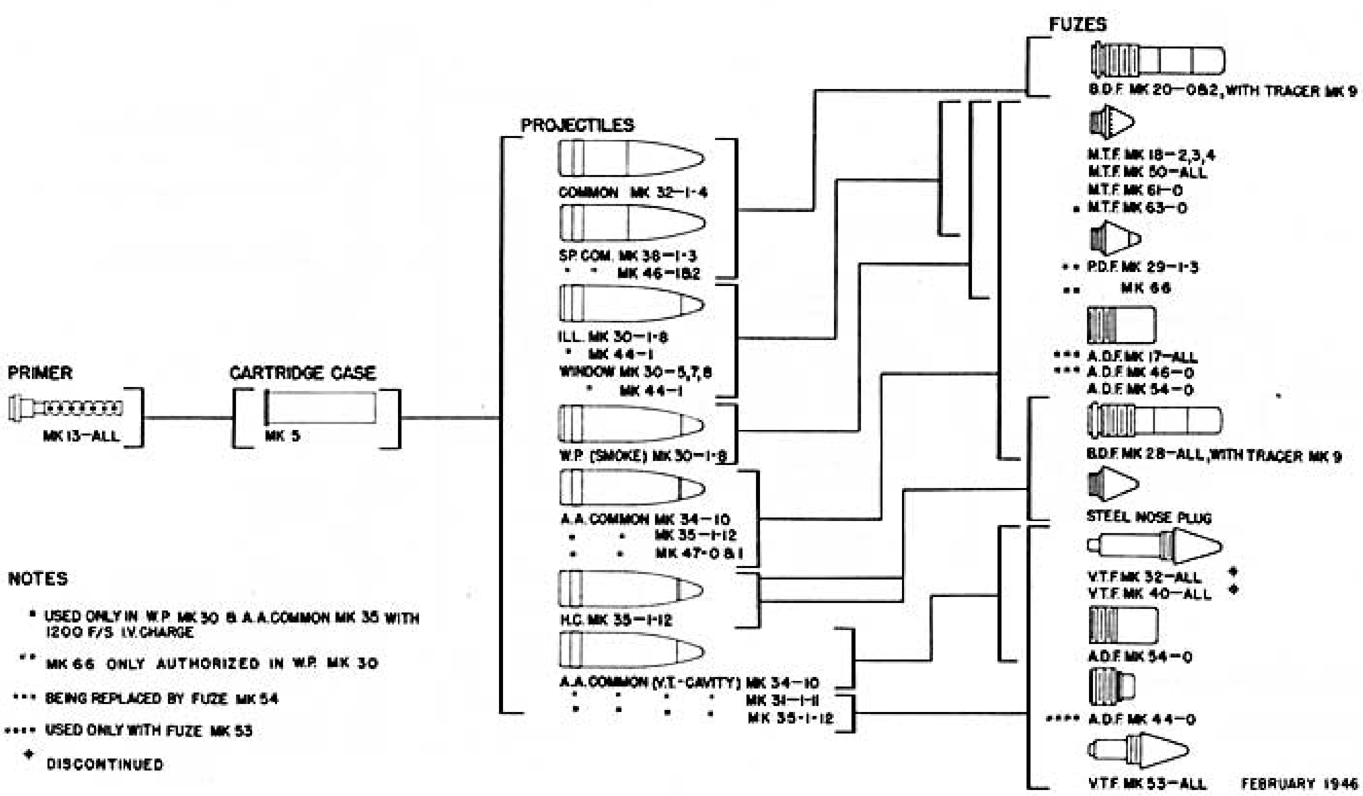


Figure 6. 5"/38 Case Gun (Ammunition)

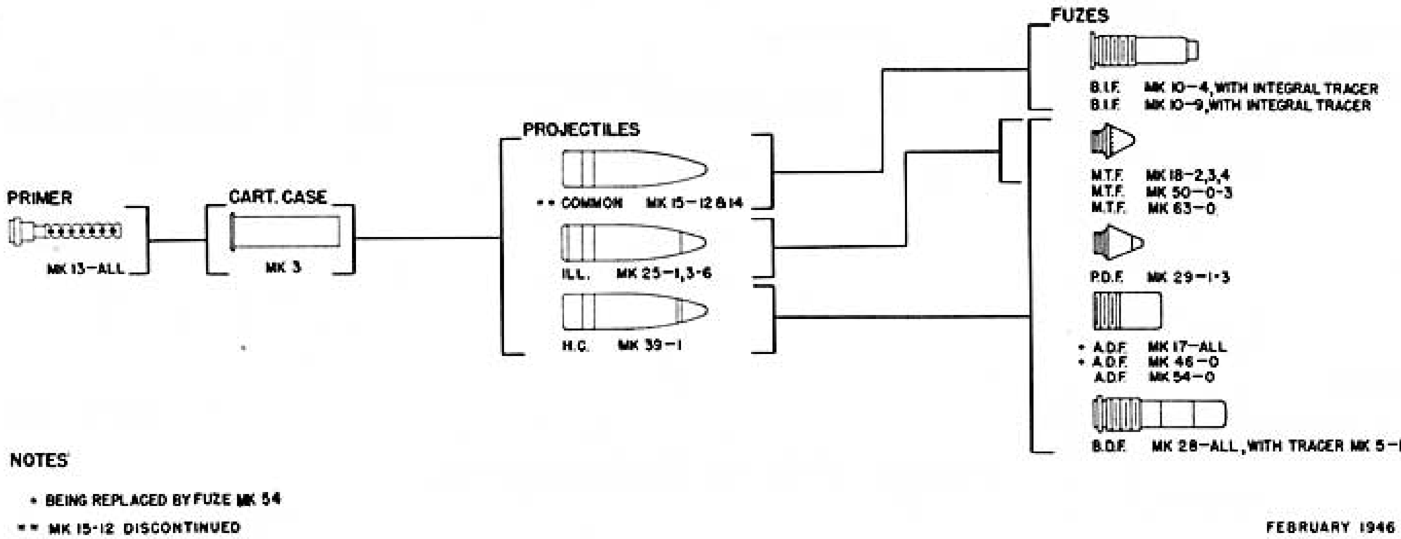


Figure 7. 5"/51 Case Gun (Ammunition)

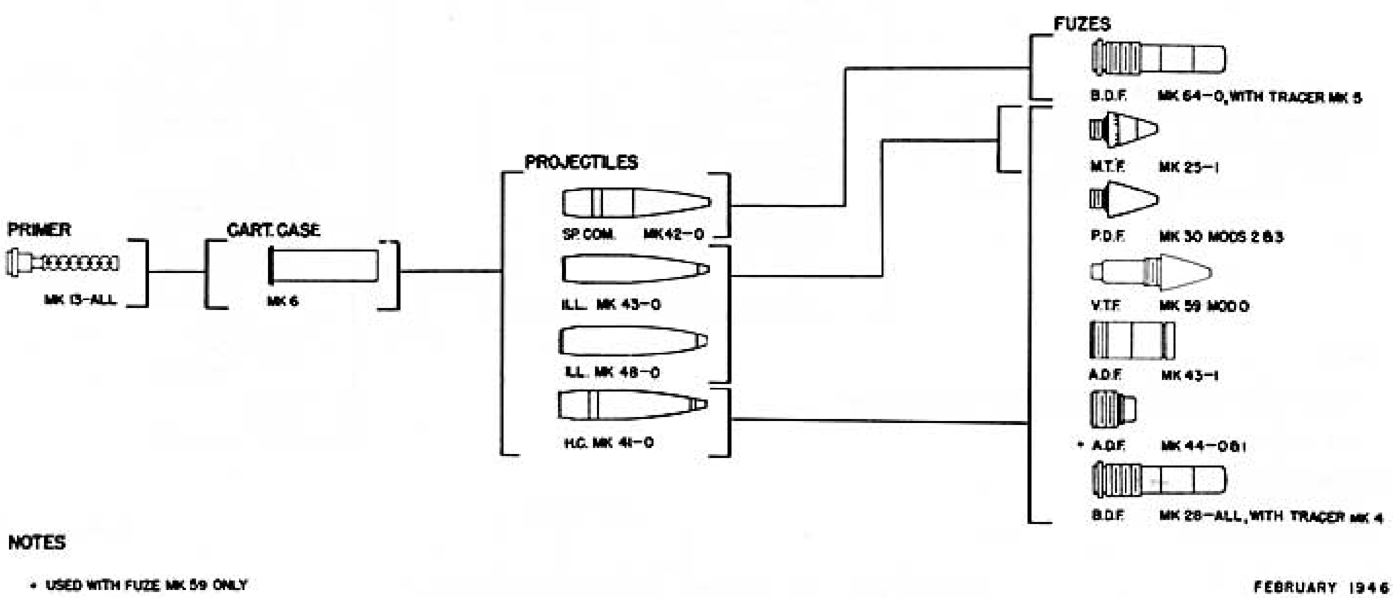
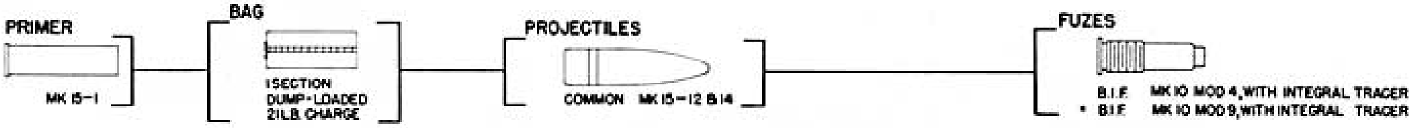


Figure 8. 5"/54 Case Gun (Ammunition)



NOTES

* TO BE USED ONLY IF MK 10 MOD 4 NOT AVAILABLE

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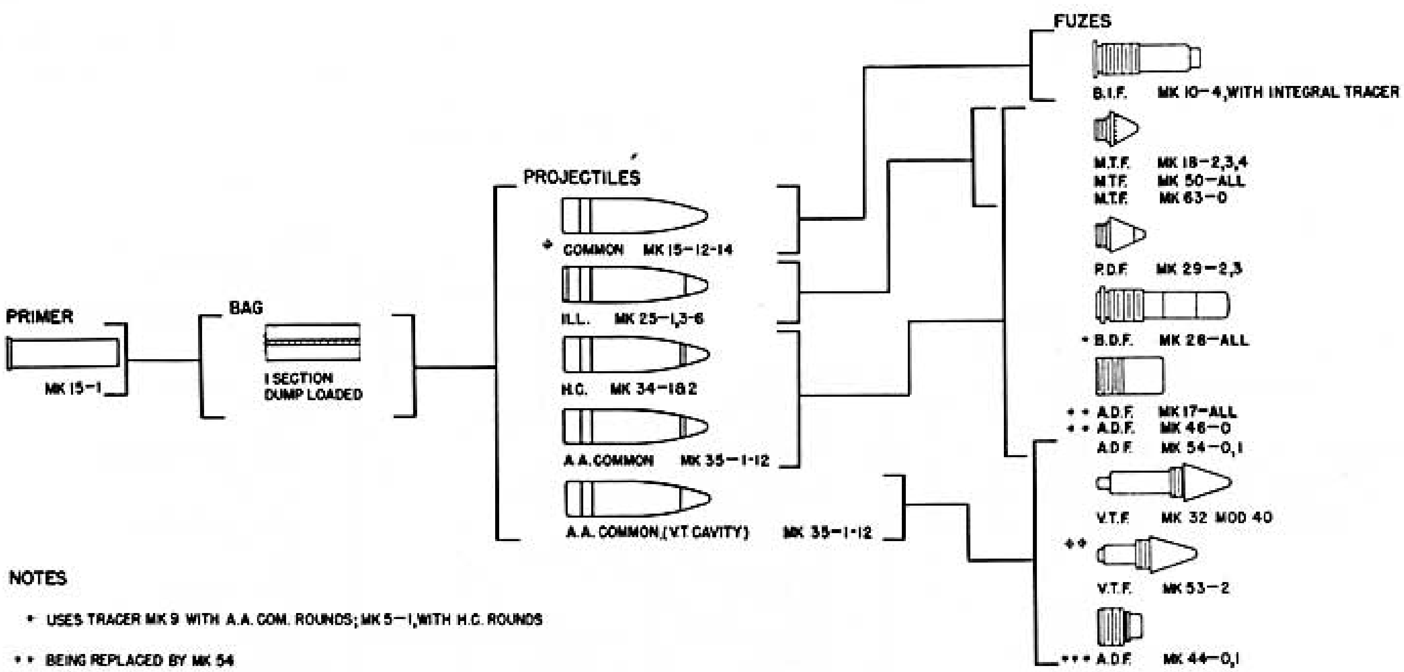
Figure 9. 5"/20 Bag Gun (Ammunition)



NOTES

* USES TRACER MK 9 WITH A.A. COM. ROUNDS; MK 5-1, WITH H.C. ROUNDS

** BEING REPLACED BY MK 54

*** USED ONLY WITH FUZE MK 53

✦ MK 15-12 DISCONTINUED

✦✦ REPLACES MK 32

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Figure 10. 5"/51 Bag Gun (Ammunition)

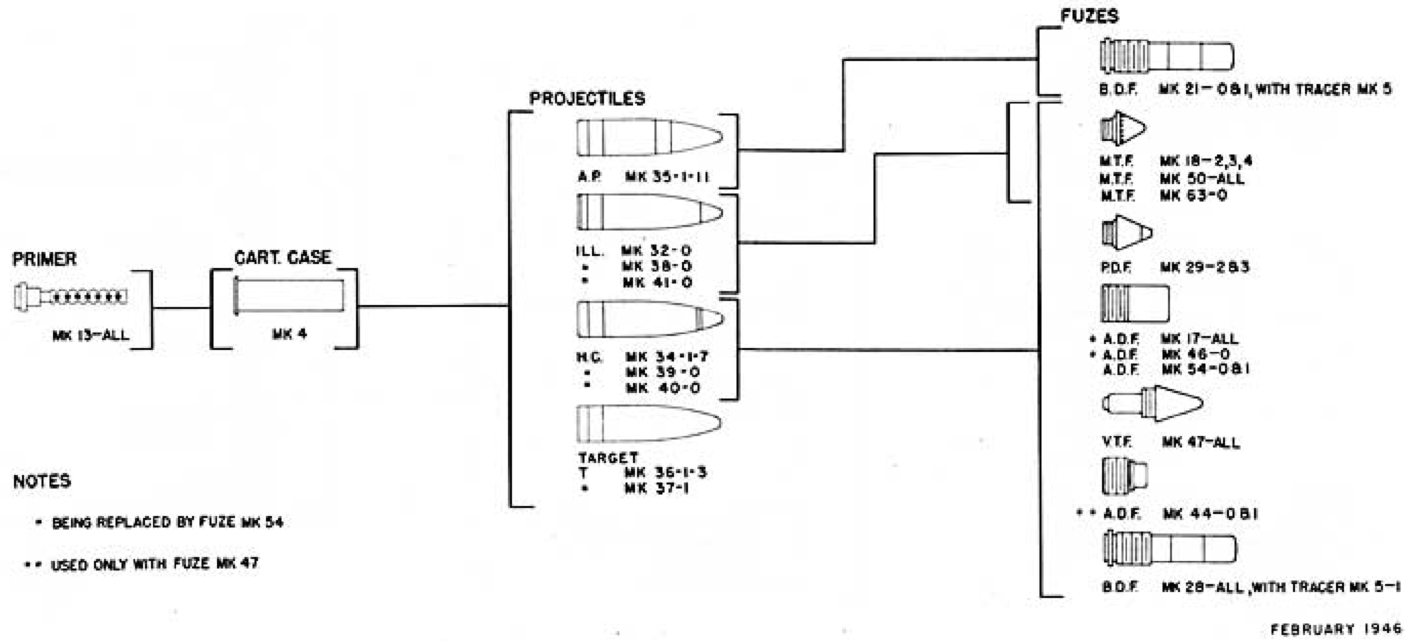
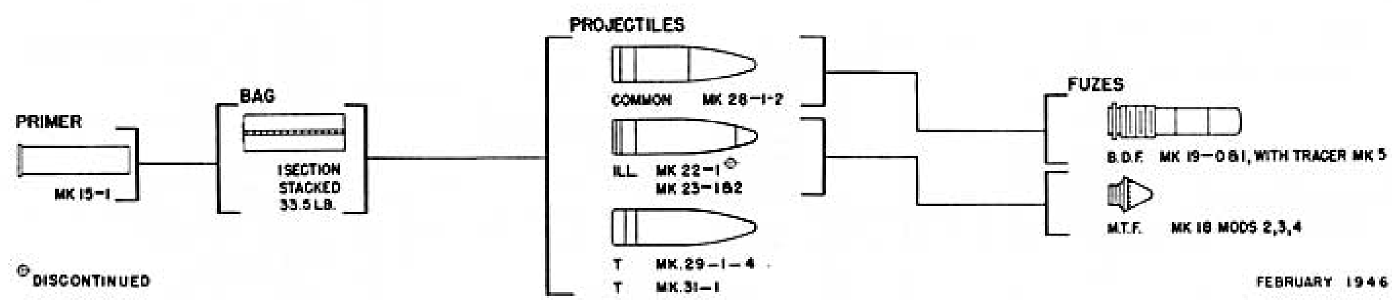


Figure 11. 6"/47 Case Gun (Ammunition)



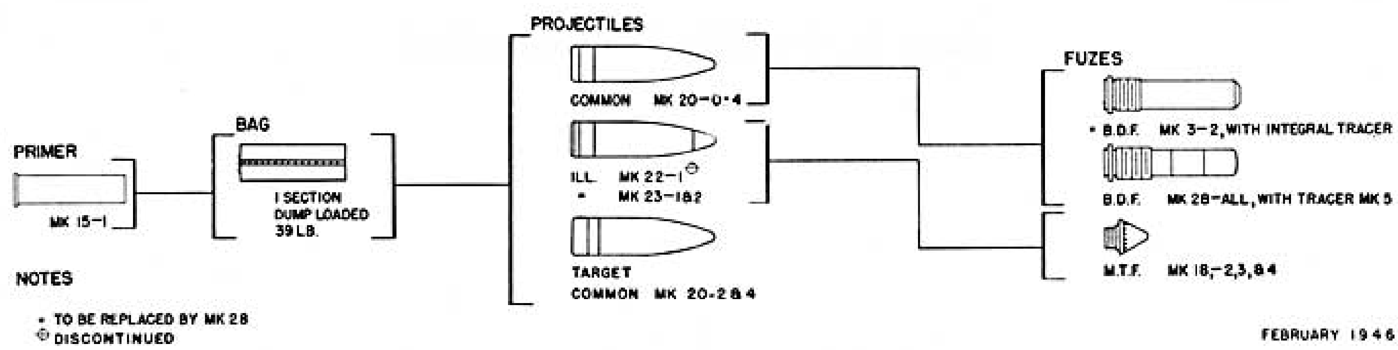


Figure 12. 6"/47 Bag Gun (above) and 6"/50 Bag Gun (below) (Ammunition)

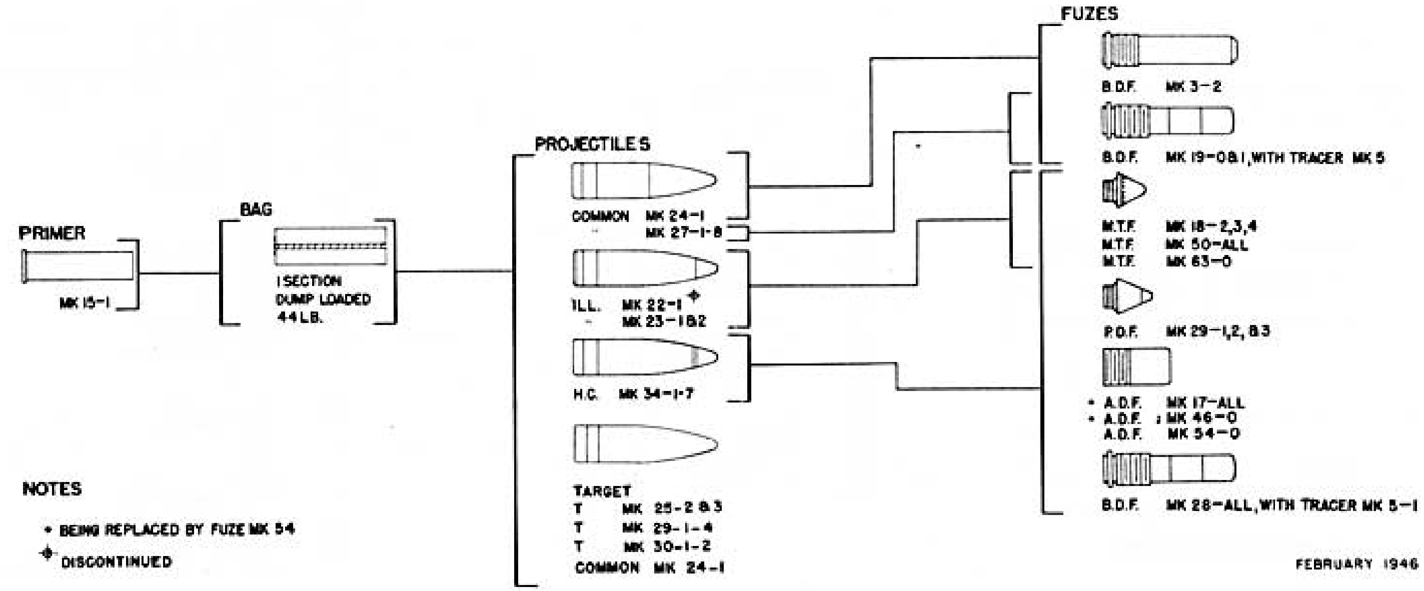


Figure 13. 6"/53 Bag Gun (Ammunition)

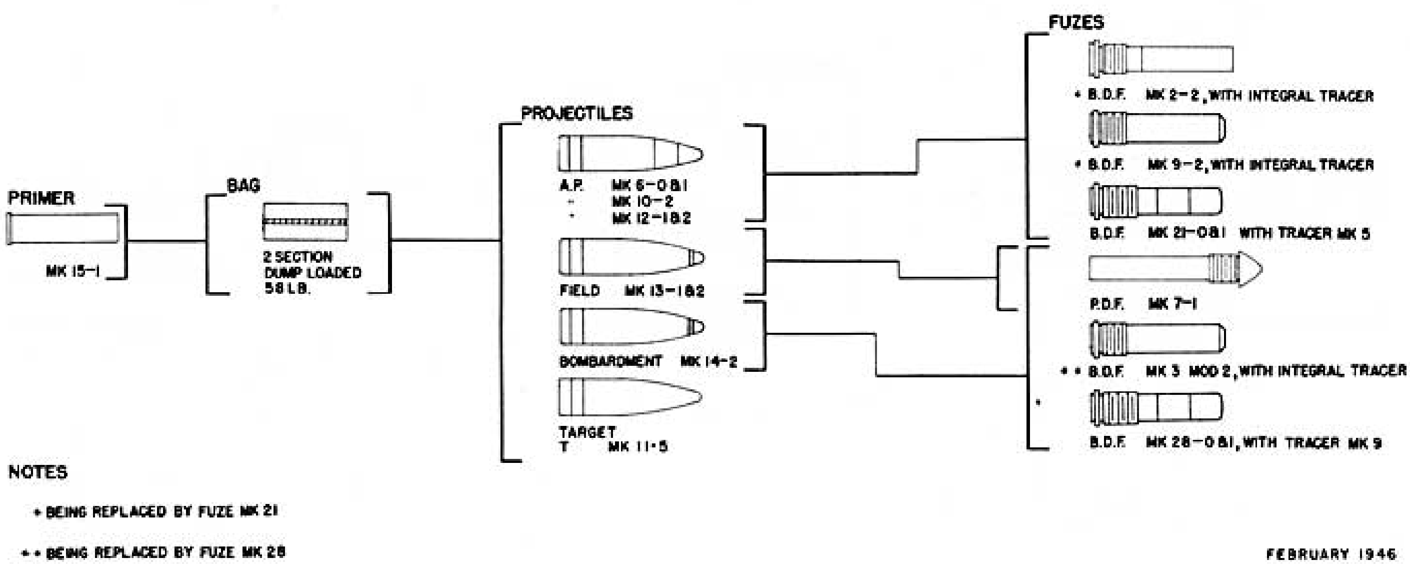


Figure 14. 7"/45 Bag Gun (Ammunition)

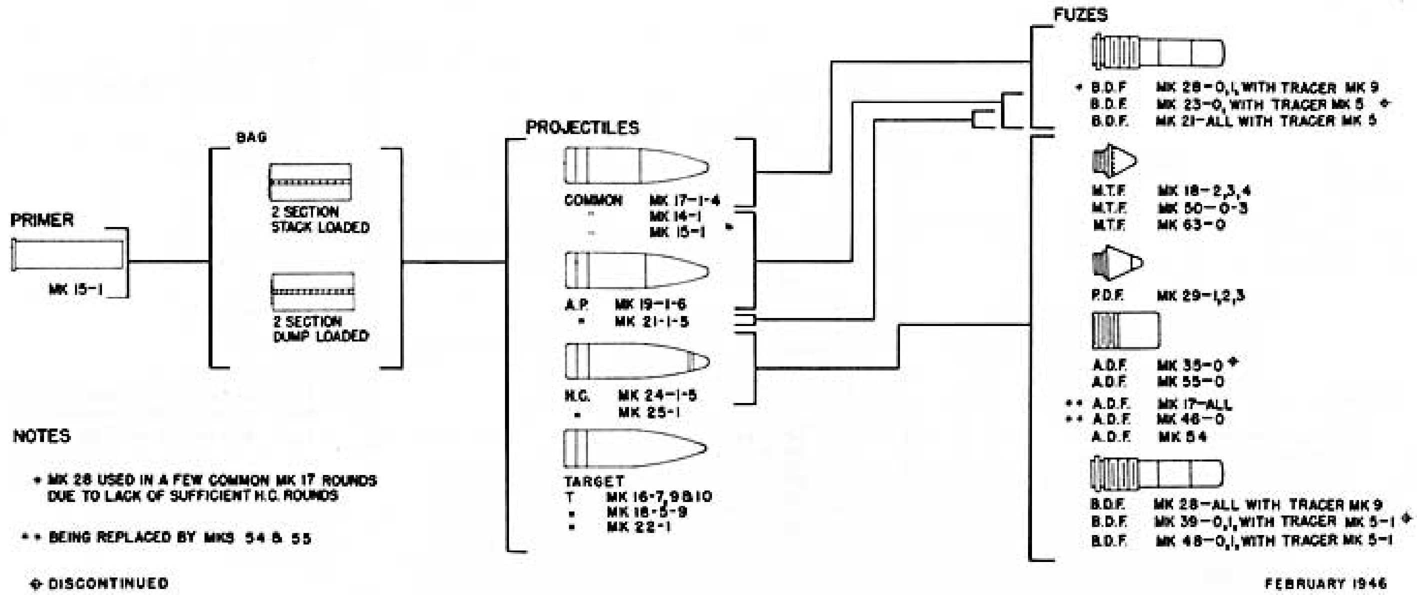


Figure 15. 8"/55 Bag Gun (Ammunition)

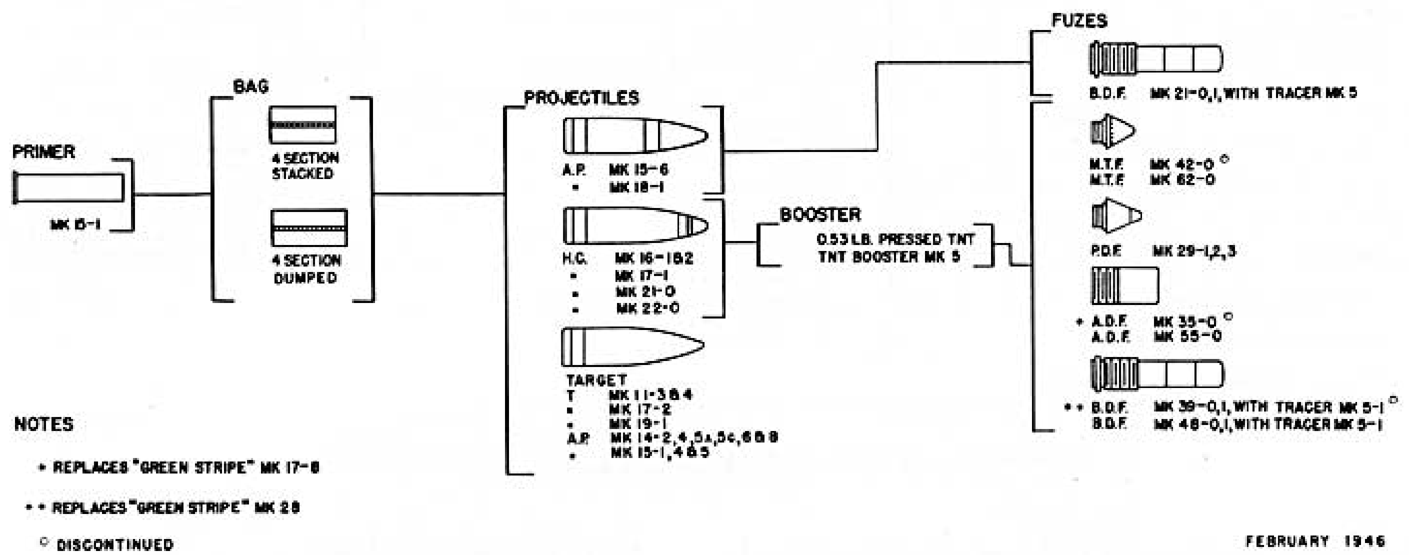


Figure 16. 12"/50 Bag Gun (Ammunition)

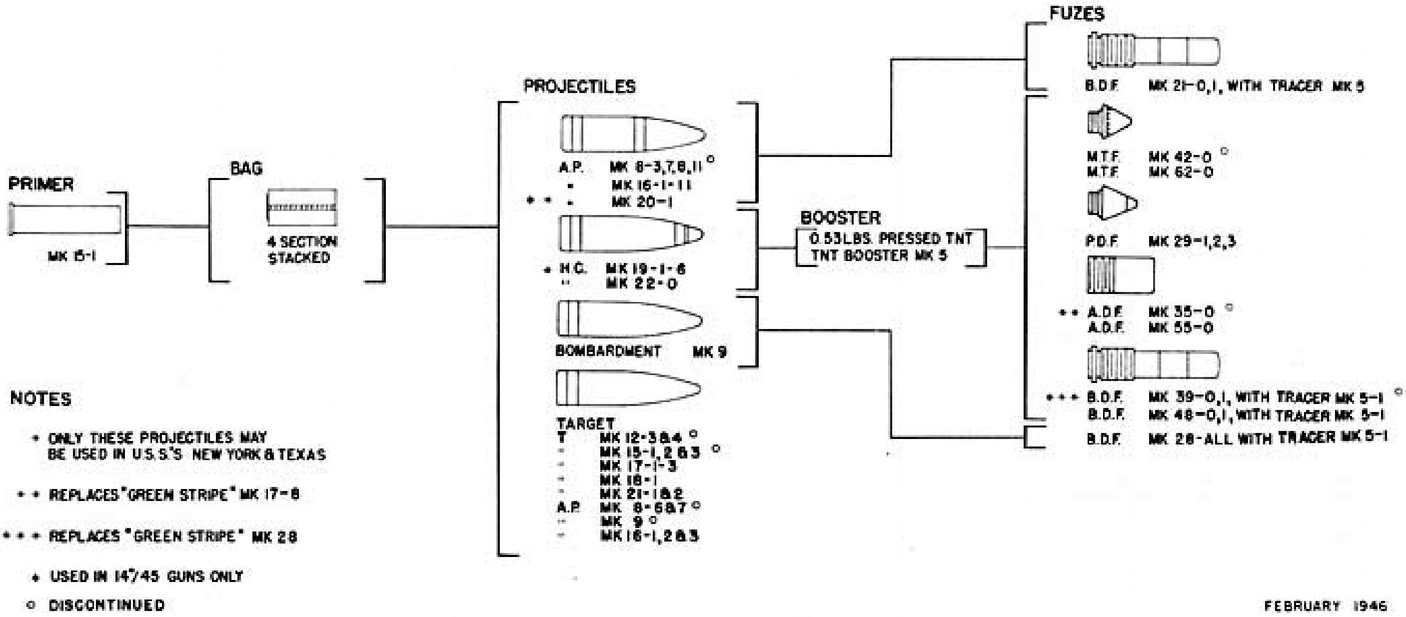


Figure 17. 14"/45 and 14"/50 Bag Guns (Ammunition)

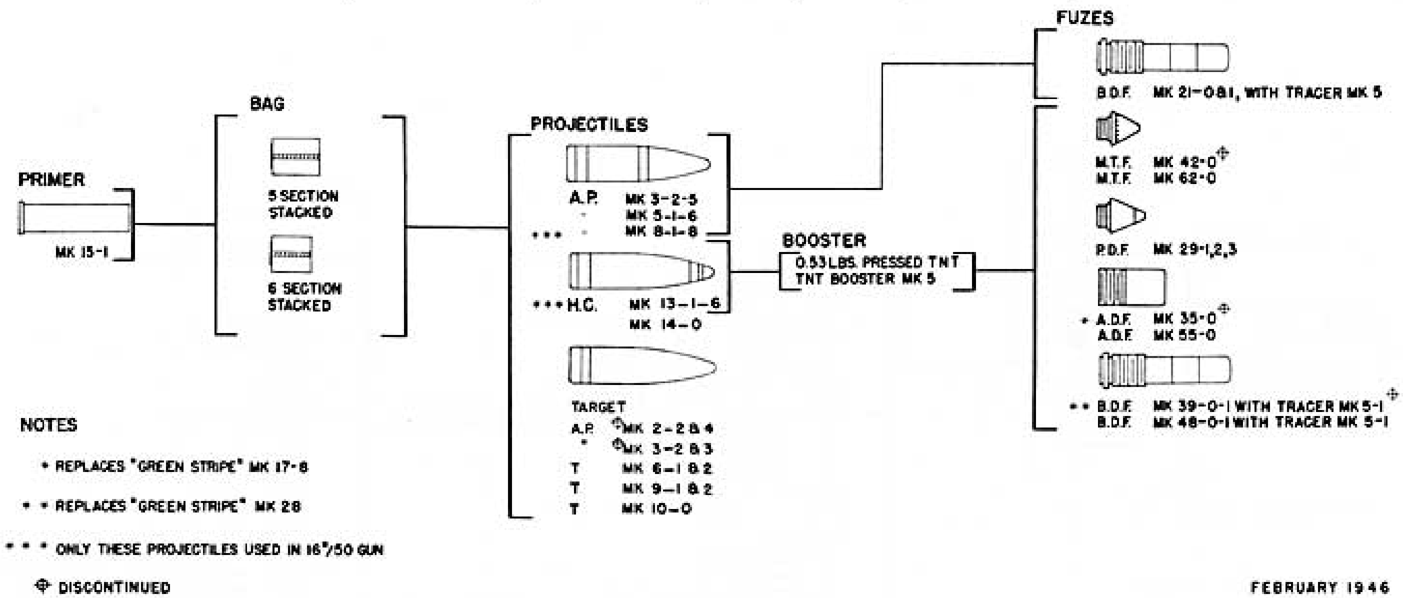


Figure 18. 16"/45 and 16"/50 Bag Guns (Ammunition)

Color and marking of older projectiles 3-inch and larger

In addition to the explosive filler, body color, spotting specifications, and base and band stamping mentioned above, the older projectiles had the following markings:

Tracer band: White band with three dots, indicating tracer color, 120° apart.

V.T. fuzing: One-half inch red band painted one-half inch abaft the nose fuze.

Stencilled on the body

Size, caliber, Mark and Mod of projectile
Mark and Mod of fuzes
Explosive filling and density of loading
Abbreviated name of loading depot
Initials of Chief Inspector
Date of filling and marking; any changes in filling, fuzing, etc.

Stamped on base

Weights before and after filling

3-INCH PROJECTILES

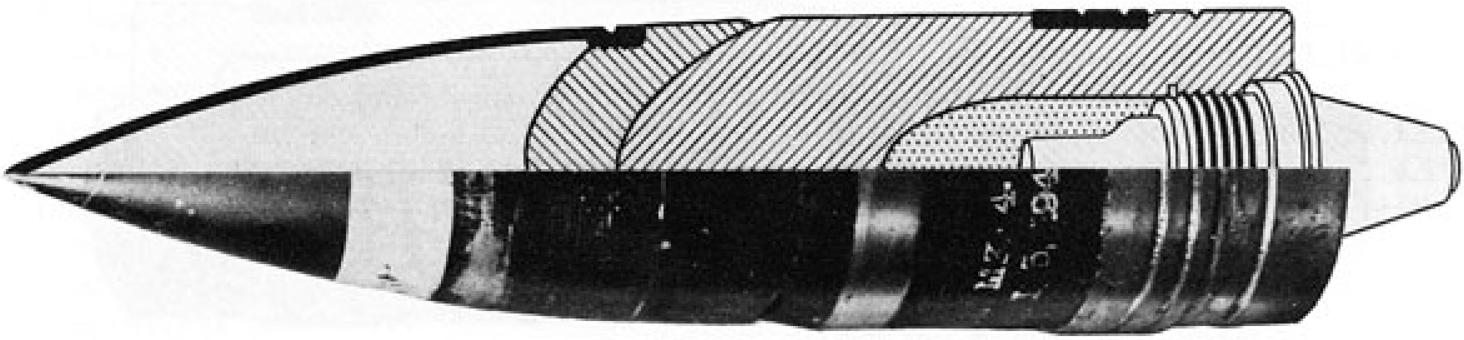


Figure 19. 3–inch A.P. Mk 29 Mods 1 and 2

3-inch A.P. Mk 29 Mods 1 and 2

Guns used in........................3"/50
Overall length, inches
  With cap & windshield..............12.16
  Without cap & windshield............6.91
Diameter of base, inches...............2.98
Distance base to band, inches...........1.35
Width of band, inches...................1.0
Diameter at bourrelet, inches..........2.985
Filling ....Explosive D
Weight of filling, pounds................0.3
Weight of loaded projectile, lb. 13.10
Charge/weight ratio 2.28%
Cartridge Case ....Mk 7 and Mk 9
Primer ....Mk 14, Mk 14 Mod 1
Tracer ....Integral
Fuzes........Army M66A1 in base (B.D.F.)

This projectile was formerly issued without any explosive filling and with the Tracer Mk 4. It is now being loaded and at present is fuzed with the Army Base Fuze M66A1.

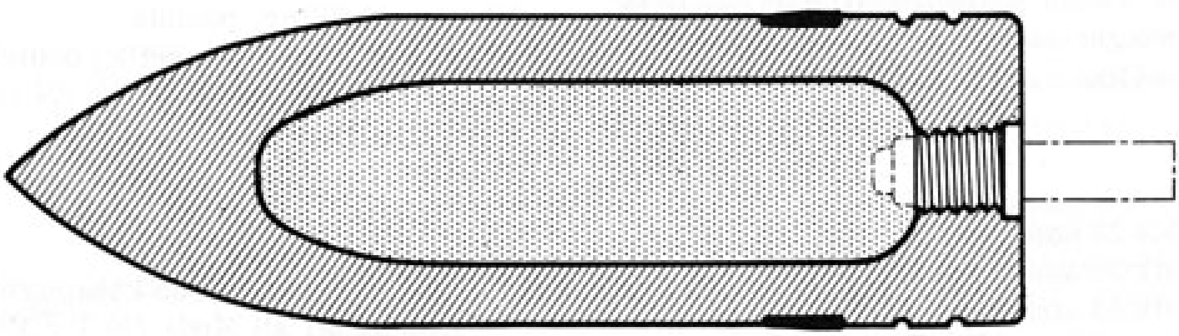


Figure 20. 3–inch Common Mk 3 Mod 7

3-inch Common Mk 3 Mod 7

Guns used in........................3"/23
Over-all length, inches..............10.035
Diameter of base, inches...............2.87
Distance base to band, inches...........1.80
Width of band, inches...................0.70
Diameter at bourrelet, inches...........2.97
Filling.............Black powder and TNT

Weight of filling, pounds..............0.28
Weight of loaded projectile, pounds......13
Charge/weight ratio 2.15%
Cartridge case ....Mk 2
Primer ....Mk 10 Mod 9
Tracer ....Integral in fuze
Fuzes.......Base Ignition Fuze Mk 8 Mod 4

Base Ignition Fuzes Mk 8 Mod 5 or Mk 2 Mod 9 (without tracers) may be used in this projectile, but the Mk 8 Mod 4 with integral tracer is preferred.

This round may also be issued B.L. & P. or B.L. & T. with the Tracer Mk 7 for target practice.

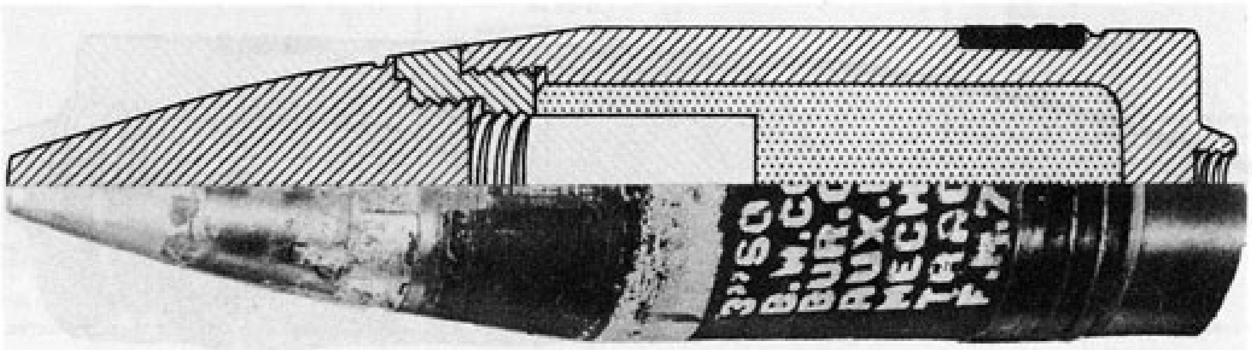


Figure 21. 3–inch A.A. Mk 23 Mods 1—3

3-inch A.A. Mk 23 Mods 1, 2, and 3 (Obsolete)

Guns used in.......................3"/50
Over-all length, inches
With nose fuze...................12.13
Without nose fuze..................8.11
Diameter of base, inches...............2.98
Distance base to band, inches...........1.80
Width of band, inches.................0.70
Diameter at bourrelet, inches..........2.98
Filling ....Cast TNT
Weight of filling, pounds..............0.74
Weight of loaded projectile, pounds....13.05
Charge/weight ratio 5.67%
Cartridge Case....Mk 3, Mk 3 Mods 2 and 3
Primer .... Mk 14
Tracer ....Mk 4
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 30 and Mods 1, 2, 3, (P.D.F.)
Mk 51 and Mods (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods or
Mk 46
Mk 54 Mod 0

The Auxiliary Detonating Fuze Mk 54 replaced the Fuzes Mk 17 and Mk 46 in all assemblies. Production of this projectile has been discontinued.

3-inch A.A. Mk 26 Mods 1 and 2

Guns used in.......................3"/23
Over-all length, inches
With nose fuze...................12.13
Without nose fuze..................8.11
Diameter of base, inches...............2.97
Distance base to band, inches...........1.80
Width of band, inches.................0.70
Diameter at bourrelet, inches..........2.98
Filling ....Cast TNT
Weight of filling, pounds..............0.74
Weight of loaded projectile, pounds....12.95
Charge/weight ratio 5.71%
Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Tracer ....Mk 4
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 all Mods (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods or
Mk 46
Mk 54 and 0

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and the Mk 46 in all assemblies.

The shape of the 3-inch A.A. Projectile Mk 26 is, for all general purposes, the same as that shown for the Mk 23.

3-inch A.A. Mk 27 Mods 1, 2, and 3

Guns used in........................3"/50
Over-all length, inches
With nose fuze......................12.13
Without nose fuze...................8.11
Diameter of base, inches..............2.98
Distance base to band, inches..........1.35
Width of band, inches.................1.00
Diameter at bourrelet, inches..........2.98
Filling ....Cast TNT
Weight of filling, pounds..............0.74
Weight of loaded projectile, pounds....13.00
Charge/weight ratio 5.67%
Cartridge case ....Mk 7 all Mods, Mk 9 Mod 0
Primer ....Mk 14, Mk 14 Mod 1
Tracer ....Mk 4
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 30, Mods 1, 2, 3 (P.D.F.)
Mk 51 all Mods (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods
Mk 46
Mk 54 Mod 0

This projectile becomes 3-inch H.C. when the Fuze Mk 30 is substituted for the Mk 22.

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and the Mk 46 in all assemblies.

This projectile's shape is almost exactly similar to that of the Mk 23.

3-inch A.A. Mk 31 Mod 1

Guns used in........................3"/50
Over-all length, inches
With nose fuze......................12.22
Without nose fuze...................8.50
Diameter of base, inches..............2.98
Distance base to band, inches..........1.35
Width of band, inches.................1.0
Diameter at bourrelet, inches.........2.985
Filling ....Cast TNT, Comp. A
Weight of filling, pounds..............0.54
Weight of loaded projectile, pounds....12.90
Charge/weight ratio 4.1%
Cartridge Case ....Mk 7, Mk 9
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 45 Mod 12 (V.T.F.)
Mk 58 and all Mods (V.T.F.)
Auxiliary Detonating Fuze
Mk 44 Mods 0 and 1

This projectile is specially cavitized to receive V.T. fuzes and their auxiliary detonating fuzes. No other fuzes may be assembled. Since V.T. fuzing is employed, no tracer is assembled; instead, the base is solid, and a special sheet-steel base cover plate is welded on, 0.031 inch thick and 2.50 inches in diameter.

This projectile replaces the original Mk 31 Mod 0, which has been recalled from service use. The Mod 0 was cavitized to receive the V.T. Fuse Mk 45 Mod 11, which differed from the Mod 12 by having a longer stem and has been declared unserviceable.

The V.T. Fuze Mk 58 is currently replacing the Mk 45 Mod 12 in all assemblies.

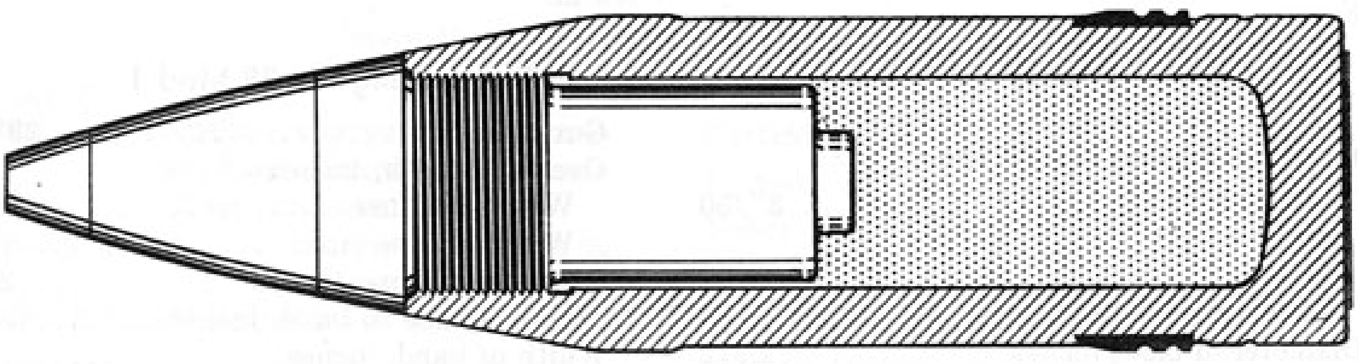


Figure 22. 3–inch A.A. Mk 31 Mod 1

3-inch Illuminating Mk 21 Mods 1, 2, and 3

Guns used in........................3"/50
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.32
Diameter of base, inches..............2.97
Distance base to band, inches............1.8
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98
Filling.....Black powder expelling charge; magnesium flare — Illuminating Contents Mk 3
Weight of filling......Expelling charge, one ounce black powder
Weight of loaded projectile, pounds....13.00
Cartridge Case ....Mk 3 Mods 2 and 3
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 and all Mods (M.T.F.)

3-inch Illuminating Mk 22 Mods 1—5

Guns used in........................3"/23
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.32
Diameter of base, inches..............2.965
Distance base to band, inches...........1.8
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98
Filling......Expelling charge is black powder; flare is magnesium; Illuminating Contents Mk 3
Weight of filling.....Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.00
Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 and all Mods (M.T.F.)

3-inch Illuminating Mk 24 Mod 1

Guns used in........................3"/50
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.35
Diameter of base, inches..............2.972
Distance base to band, inches..........1.80
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98
Filling......Black powder expelling charge; magnesium flare; Illuminating Contents Mk 3
Weight of filling......Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.04
Cartridge Case ....Mk 3, 3–2, or 3–3
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 and all Mods (M.T.F.)

3-inch Illuminating Mk 25 Mod 1

Guns used in........................3"/50
Over-all length, inches
With nose fuze....................13.07
Without nose fuze..................9.35
Diameter of base, inches..............2.962
Distance base to band, inches..........1.35
Width of band, inches..................1.00
Diameter at bourrelet, inches..........2.98
Filling......Expelling charge is black powder; flare is magnesium; Illuminating Contents Mk 3
Weight of filling......Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.07
Cartridge Case ....Mk 7 or Mk 9
Primer ....Mk 14, Mk 14 Mod 1
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 all Mods (M.T.F.)

Lot numbers 9 through 98 of the Fuze Mk 22 Mods 2 and 3 are authorized for use with Projectile Mk 25 and Mods in the guns Mk 21 and Mk 22.

3-inch Illuminating Mk 28 Mod 1

Guns used in........................3"/23
Over-all length, inches
With nose fuze.................... 7
Without nose fuze..................9.35
Diameter of base, inches..............2.965
Distance base to band, inches...........1.8
Width of band, inches..................0.70
Diameter at bourrelet, inches..........2.98

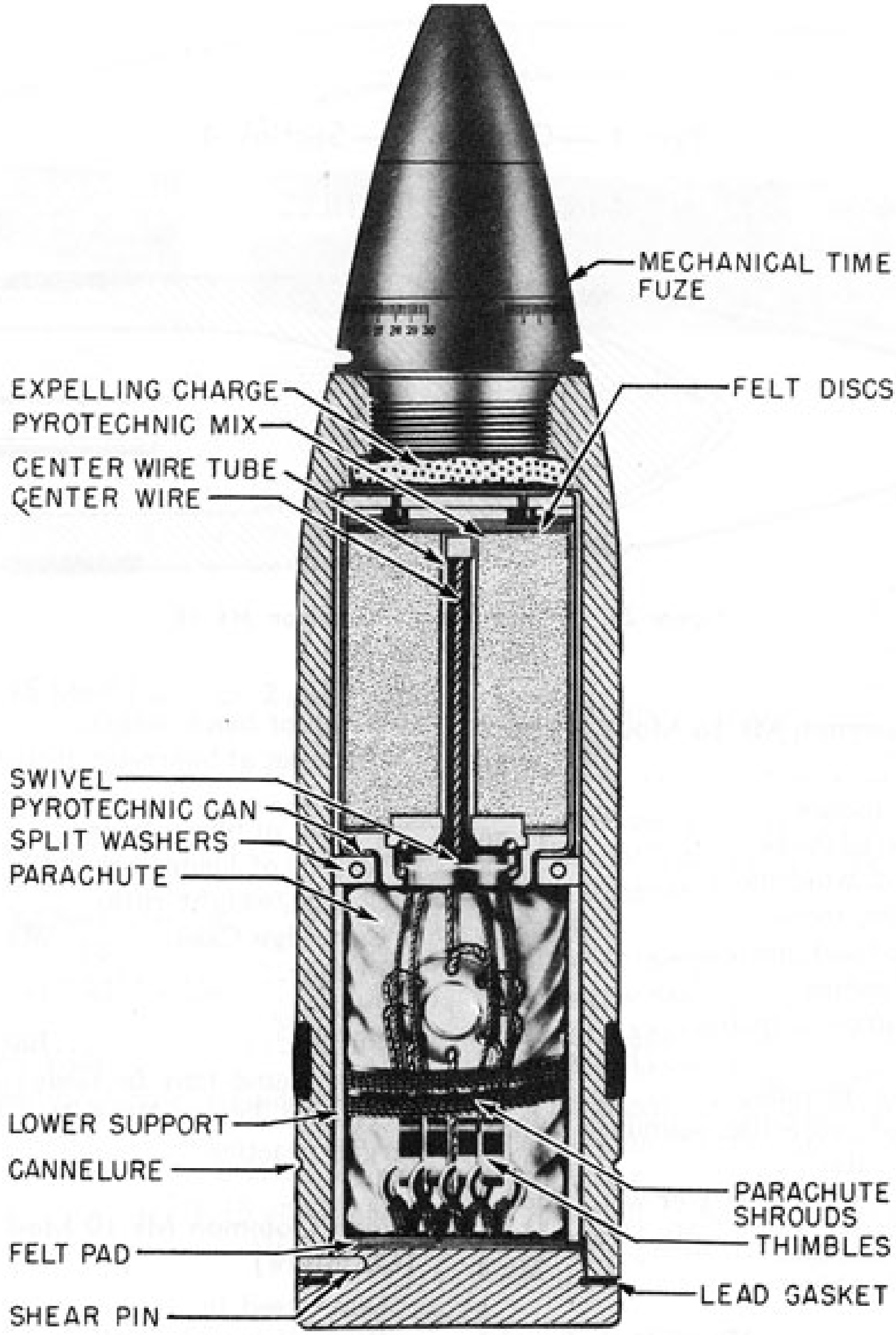


Figure 23. 3–inch Illuminating Mk 28 Mod 1

Filling......Expelling charge is black powder; flare is magnesium; Illuminating Contents Mk 3
Weight of filling......Expelling charge is 3/8 ounce
Weight of loaded projectile, pounds....13.00

Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Fuzes
Nose Mk 22 and Mods 1 through 5 (M.T.F.)
Mk 51 all Mods (M.T.F.)

4-INCH PROJECTILES

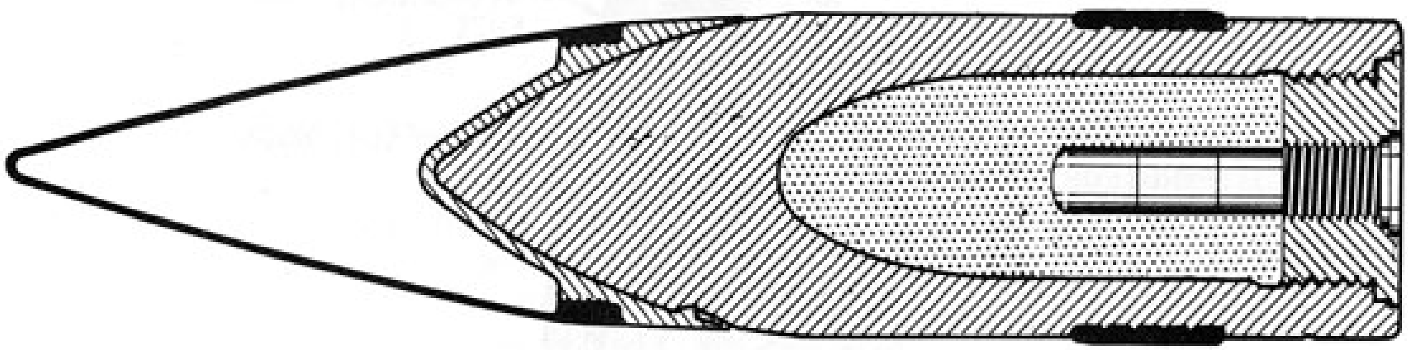


Figure 24. 4–inch Special Common Mk 16 Mods 1 and 2

4-inch Special Common Mk 16 Mods 1 and 2

Guns used in........................4"/50
Over-all length, inches
With cap & windshield.............17.50
Without cap & windshield..........11.42
Diameter of base, inches..............3.96
Distance base to band, inches...........2.25
Width of band, inches.................1.85
Diameter at bourrelet, inches.........3.985
Filling ....Explosive D
Weight of filling, pounds..............1.16
Weight of loaded projectile, pounds....33.00
Charge/weight ratio................3.03%
Cartridge Case..Mk 2 Mod 1 or Mk 2 Mod 4
Primer ....Mk 13 and Mods
Tracer ....Mk 4
Fuzes
Base................Mk 36 Mods 0 and 1
Mk 20 Mods 1 and 2

The Base Fuze Mk 36 is the preferred assembly and is replacing the Mk 20.

This projectile is specially strengthened for extra armor-piercing qualities.

4-inch Common Mk 6 Mod 6 (Obsolete)

Guns used in........................4"/50
Over-all length, inches................15.8
Diameter of base, inches..............3.96
Distance base to band, inches..........2.90
Width of band, inches..................1.02
Diameter at bourrelet, inches..........3.985
Filling.............Black powder and TNT
Weight of filling, pounds...............1.39
Weight of loaded projectile, pounds.....33.0
Charge/weight ratio 4.21%
Cartridge Case........Mk 2 or Mk 2 Mod 3
Primer...................Mk 13 and Mods
Tracer ....Integral
Fuzes................Base — Mk 10 Mod 4

This round may be issued B.L. & P. or B.L. & T. with Tracer Mk 6 Mod 1 and adapter for target practice.

4-inch Common Mk 10 Mods 1, 2, and 3 (Obsolete)

Guns used in.......................4"/50
Over-all length, inches...............15.80
Diameter of base, inches..............3.96
Distance base to band, inches..........2.75
Width of band, inches.................1.33
Diameter at bourrelet, inches.........3.985
Filling............Black powder and TNT
Weight of filling, pounds..............1.39
Weight of loaded projectile, pounds.....33.0
Charge/weight ratio 4.21%
Cartridge Case........Mk 2 or Mk 2 Mod 3
Primer..................Mk 13 and Mods
Tracer ....Integral in fuze

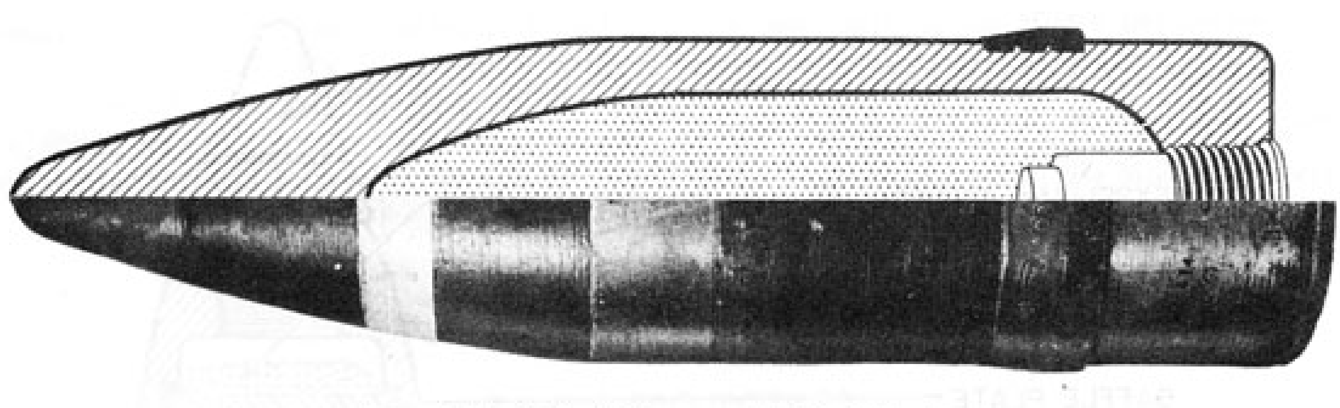


Figure 25. 4–inch Common Mk 10 Mods 1—3

Fuzes..............Base — Mk 10 Mod 4

For target practice, this round is also issued B.L. & P. or B.L. & T. with adapter and Tracer Mk 6 Mod 1.

4-inch H.C. Mk 15 Mod 1 and Ex-2 and Ex-2-1

Guns used in......................4"/50
Overall length, inches
  With nose fuze....................18.00
  Without nose fuze..................14.28
Diameter of base, inches..............3.96
Distance base to band, inches..........2.25
Width of band, inches................1.85
Diameter at bourrelet, inches.........3.985
Filling ....Explosive D
Weight of filling, pounds..............2.71
Weight of loaded projectile, pounds....33.00
Charge/weight ratio...............8.21%
Cartridge Case.........Mk 2 Mods 1 and 4
Primer ....Mk 13 and all Mods
Tracer.....................Mk 4 or Mk 9

Fuzes
  Base.........Mk 31 or Mk 28 (B.D.F.)
  Nose.........Mk 30 Mods 1, 2, 3 (P.D.F.)
    Mk 22 Mods 1–5 (M.T.F.)
    Steel nose plug
    Mk 51 and all Mods (M.T.F.)
  Auxiliary Detonating Fuze
    Mk 17 or Mk 46
    Mk 54 Mod 0

The Base Fuze Mk 31 is preferred for this projectile. The Tracer Mk 4 is used with the Base Fuze Mk 31; the Mk 9, with the Fuze Mk 28.

The 4"/50 Ex-2 and Ex-2-1 are identical to Projectile Mk 15 except they are one pound heavier. Approximately 18,000 of the Ex projectiles were manufactured and issued.

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and the Mk 46 fuzes in all assemblies.

Assembly of the Nose Fuze Mk 22 (M.T.F.) with this projectile has stopped.

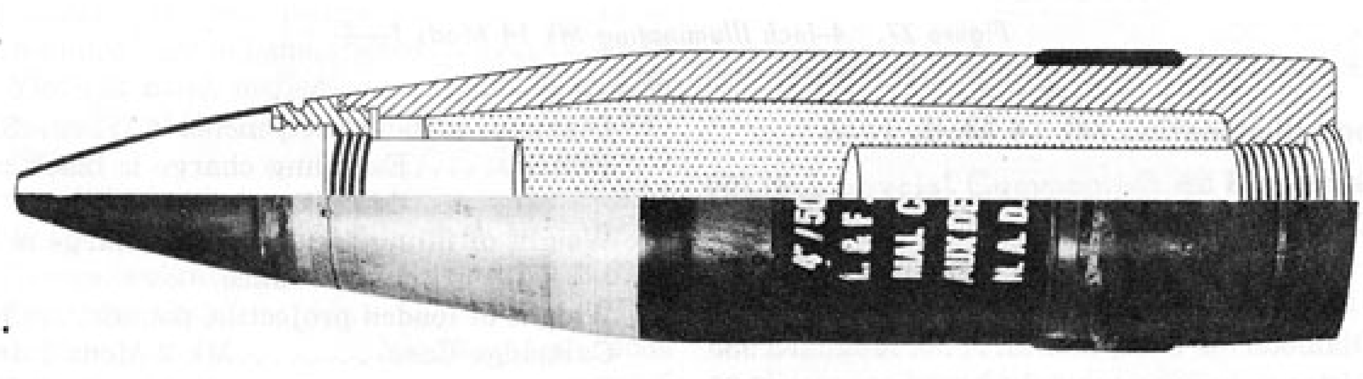


Figure 26. 4–inch H.C. Mk 15 Mod 1

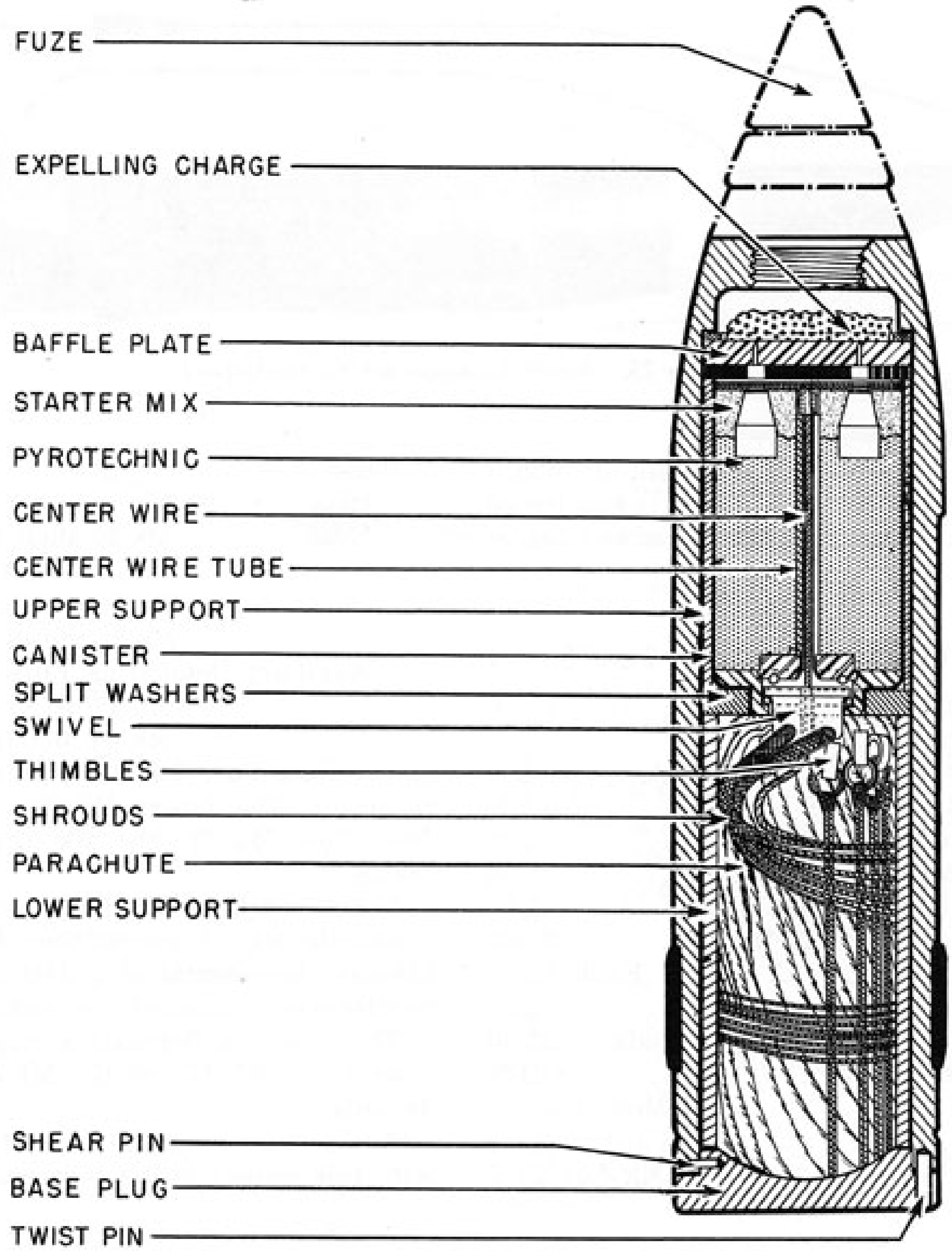


Figure 27. 4–inch Illuminating Mk 14 Mods 1—6

4-inch Illuminating Mk 14 Mods 1—6

Guns used in........................4"/50
Over-all length, inches
  With nose fuze...................18.40
  Without nose fuze.................14.92
Diameter of base, inches.............3.933
Distance base to band, inches..........2.25
Width of band, inches................1.85
Diameter at bourrelet, inches.........3.985
Filling......Expelling charge is black powder; flare, magnesium
Weight of filling....Expelling charge is 1.25 ounce
Weight of loaded projectile, pounds....34.66
Cartridge Case.........Mk 2 Mods 1 and 4
Primer................Mk 13 and all Mods
Tracer ....None

Fuzes..............Mk 18 Mods 2, 3, and 4
Mk 50 all Mods
Mk 63 Mod 0

The Fuze Mk 18 may be used in all Mods of this projectile; the Fuzes Mk 50 and Mk 63 are used only in the Mod 6 projectile.

Illuminating Contents Mk 3 are used in projectiles Mods 1–5; the Illuminating Contents Mk 4 Mod 4 are used in the Mod 6 projectile.

Part I — Chapter I — Section 4

5-INCH PROJECTILES

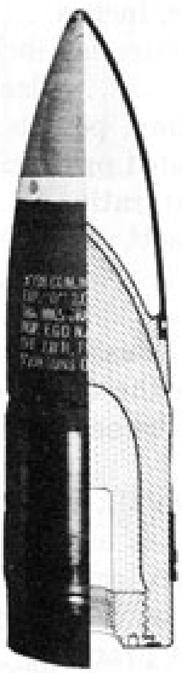


Figure 28. 5–inch Special Common Mk 38 Mods 1—3

5-inch Special Common Mk 38 Mods 1, 2, and 3

Guns used in........................5″/38
Over-all length, inches................20.7
Diameter of base, inches.............4.985
Distance base to band, inches...........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches..........4.985
Filling ....Explosive D
Weight of filling, pounds..............2.04
Weight of loaded projectile, pounds....55.18
Charge/weight ratio................3.69%
Cartridge Case ....Mk 5
Primer................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes..........Base — Mk 20 and all Mods

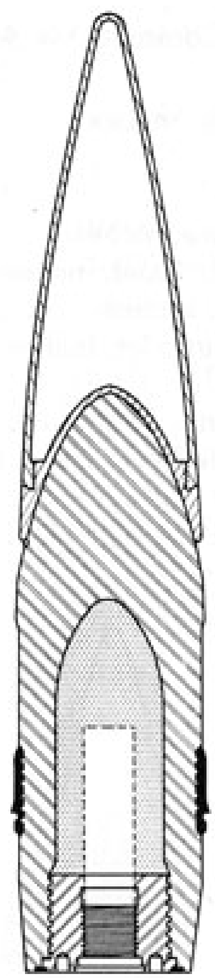


Figure 29. 5–inch Special Common Mk 42 Mods 0 and 1

5-inch Special Common Mk 42 Mods 0 and 1

Guns used in........................5″/54
Over-all length, inches................26.0
Without windshield 15.605
Diameter of base, inches..............4.26
Distance base to band, inches..........3.75
Width of band, inches................2.25

Diameter at bourrelet, inches 4.985
Filling . . . . Explosive D
Weight of filling, pounds 2.14
Weight of loaded projectile, pounds 70
Charge/weight ratio 3.06%
Cartridge Case . . . . Mk 6
Primer . . . . Mk 13 and all Mods
Tracer . . . . Mk 5 (probably)
Fuzes . . . . Base — Mk 64 Mod 0

The Tracer Mk 9 may possibly be used in this projectile, although the Mk 5 is the preferred assembly.

5-inch Special Common Mk 46 Mods 1 and 2

Guns used in . . . . 5"/38
Over-all length, inches
  With cap 20.70
  Without cap 12.485
Diameter of base, inches 4.985
Distance base to band, inches 2.43
Width of band, inches 2.25
Diameter at bourrelet, inches 4.985
Filling . . . . Explosive D
Weight of filling, pounds 2.04
Weight of loaded projectile, pounds 55.18
Charge/weight ratio 3.69%
Cartridge Case . . . . Mk 5
Primer . . . . Mk 13 and all Mods
Tracer . . . . Mk 9
Fuzes . . . . Base — Mk 20 Mods 0–2

5-inch Common Mk 15 Mods 12—14

(All but Mod 14 are obsolete.)
Guns used in . . . . 5"/50 (bag)
5"/51 (bag)
5"/51 (case)
Over-all length, inches 17.0
Diameter of base, inches 4.96
Distance base to band, inches 0.65
Width of band, inches 1.67
Diameter at bourrelet, inches 4.985
Filling . . . . Black powder and TNT
Weight of filling, pounds 1.70
Weight of loaded projectile, pounds 50.0
Charge/weight ratio 3.46%
Cartridge Case . . . . Bag gun
Primer . . . . Mk 15 Mod 1
Tracer . . . . Integral in fuze
Fuzes . . . . Base — Mk 10 Mod 4 (B.I.F.)

When used in the 5"/51 case gun, Cartridge Case Mk 3 and Primer Mk 13 and all Mods are employed.

The Base Fuze Mk 10 Mod 9 may be used if the Mk 10 Mod 4 is unavailable.

The Mod 14 projectile may be issued B.L. & P. or B.L. & T. with adapter and Tracer Mk 6 Mod 1 for target practice.

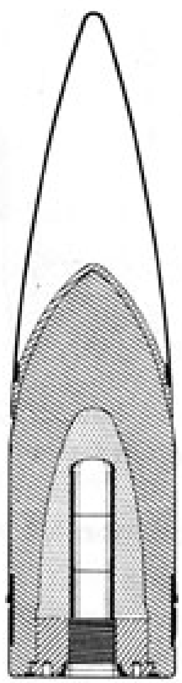


Figure 30. 5–inch Special Common Mk 46 Mods 1 and 2

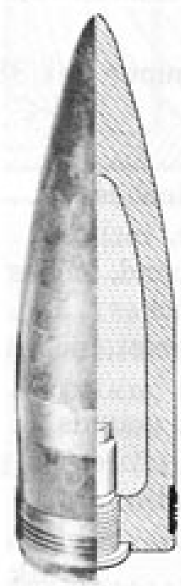


Figure 31. 5–inch Common Mk 15 Mods 12 and 14

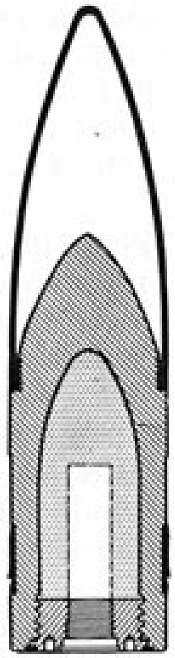


Figure 32. 5–inch Common Mk 32 Mods 1—4

5-inch Common Mk 32 Mods 1—4

Guns used in........................5″/38
Over-all length, inches
With cap & windshield...............20.7
Without cap & windshield...........13.6
Diameter of base, inches..............4.973
Distance base to band, inches..........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches.........4.985
Filling ....Explosive D
Weight of filling, pounds..............2.58
Weight of loaded projectile, pounds....54.00
Charge/weight ratio.................5.0%
Cartridge Case ....Mk 5
Primer.................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes..........Base — Mk 20 and all Mods

5-inch H.C. Mk 39 Mods 1 and 2

Guns used in........................5″/51
Bag or case gun
Over-all length, inches
With nose fuze.....................17.0
Without nose fuze.................13.18
Diameter of base, inches.............4.985
Distance base to band, inches...........1.15
Width of band, inches..................2.0
Diameter at bourrelet, inches.........4.985
Filling ....Explosive D
Weight of filling, pounds..............3.65
Weight of loaded projectile, pounds.....50.0
Charge/weight ratio.................7.0%
Cartridge Case...................Bag gun
Primer......................Mk 15 Mod 1
Tracer......................Mk 5 Mod 1
Fuzes
Base.....Mk 28 and Mods
Nose.....Mk 29 Mods 2 and 3 (P.D.F.)
Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 and all Mods (M.T.F.)
Mk 63 Mod 0 (M.T.F.)
Steel Nose Plug
Auxiliary Detonating Fuze
Mk 17 and Mods
Mk 46 Mod 0
Mk 54 Mod 0 and 1

Only a very few 5″/51 guns are in service in the fleet.

When employed in the 5″/51 case gun, Cartridge Case Mk 3 and Primer Mk 13 and all Mods are used.

The Auxiliary Detonating Fuze Mk 54 is replacing the Mk 17 and Mk 46 in all assemblies.

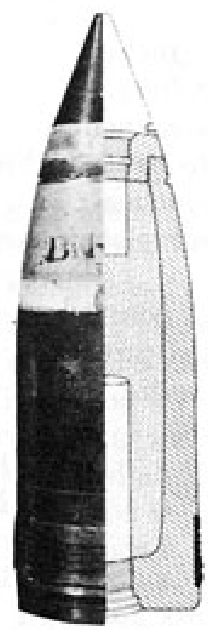


Figure 33. 5–inch H.C. Mk 39 Mods 1 and 2

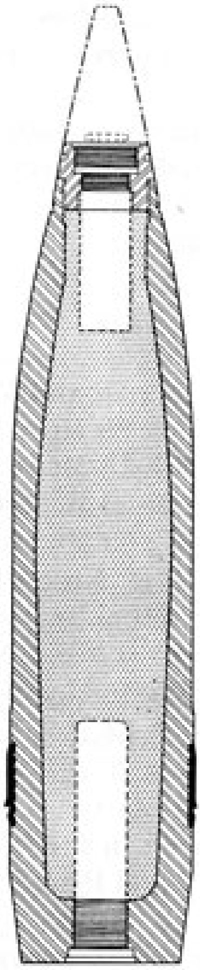


Figure 34. 5–inch H.C. Mk 41 Mod 0

5-inch H.C. Mk 41 Mod 0

Guns used in	5″/54
Over-all length, inches	26.0
Without nose fuze	22.28
Diameter of base, inches	4.26
Distance base to band, inches	3.75
Width of band, inches	2.25
Diameter at bourrelet, inches	4.985
Filling	Explosive D
Weight of filling, pounds	7.59
Weight of loaded projectile, pounds	70
Charge/weight ratio	10.84%
Cartridge Case	Mk 6
Primer	Mk 13 and all Mods
Tracer	Mk 9 (probably)
Fuzes	
Base	Mk 28 and all Mods
Nose	Mk 25 Mod 1 (M.T.F.)
	Mk 30 Mods 2 and 3 (P.D.F.)
	Mk 59 Mod 0 (V.T.F.)
Auxiliary Detonating Fuze	Mk 43 Mod 1
	Mk 44 Mods 0 and 1

The Tracer Mk 5 may be used in this projectile, although the Mk 9 is the preferred assembly.

When the V.T. Fuze Mk 59 is employed, the projectile adapter is removed, and no base fuze or tracer is employed. The base is closed by a gas-checked base-fuze plug.

When the V.T. Fuze Mk 59 is used in this projectile, the Auxiliary Detonating Fuze Mk 44 is used instead of the Mk 43. With all other types of nose fuzing, the Auxiliary Detonator Mk 43 is employed.

5-inch A.A. Common Mk 28 Mod 9 (Obsolete)

Guns used in	5″/25
Over-all length, inches	
With nose fuze	20.70
Without nose fuze	16.945
Diameter of base, inches	4.973
Distance base to band, inches	2.43
Width of band, inches	2.0
Diameter at bourrelet, inches	4.985
Filling	Exp. D, Comp. A
Weight of filling, pounds	7.33

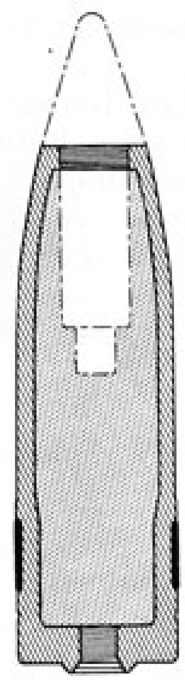


Figure 35. 5–inch A.A. Common Mk 28 Mod 9

Weight of loaded projectile, pounds.....51.7
Charge/weight ratio................14.0%
Cartridge Case......................Mk 4
Primer..............Mk 13 and all Mods
Tracer ....None
Fuzes
Nose............Mk 32 all Mods (V.T.F.)
Mk 40 all Mods (V.T.F.)
Auxiliary Detonating Fuze
Mk 17 and Mods
Mk 46 Mod 0
Mk 54 Mod 0

This projectile is fuzed with V.T. fuzes only. The projectile adapter is removed, and a gas-checked base plug is inserted. No tracer or base fuze is used with this projectile.

The Fuze Mk 40 and Mods is currently replacing the Mk 32 and Mods in all assemblies. The Auxiliary Detonating Fuze Mk 54 is replacing the Fuzes Mk 17 and Mk 46 in all assemblies.

This round is also issued B.L. & P. or B.L. & T. with the Tracer Mk 6 and adapter, or a cut-off Base Fuze Mk 13 for target practice.

5-inch A.A. Common Mk 31 Mods 1—11

Guns used in.......................5"/38
Over-all length, inches
With nose fuze.....................20.7
Without nose fuze................16.625
Diameter of base, inches...............4.97
Distance base to band, inches..........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches..........4.985
Filling...................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....55.12
Charge/weight ratio...............13.33%
Cartridge Case ....Mk 5
Primer ....Mk 13 and all Mods
Tracer ....None
Fuzes
Nose........Mk 32 and all Mods (V.T.F.)
Mk 40 and all Mods (V.T.F.)
Mk 53 and all Mods (V.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 44 Mod 0 and 1
Mk 46 Mod 0
Mk 54 Mod 0 and 1

The Mk 31 projectile was originally designed to receive the Base Fuze Mk 13, which is now obsolete. The projectile will now be found fitted only with V.T. fuzes and a plug in the base.

The Nose Fuze Mk 40 is replacing the Mk 32 and Mods. With these fuzes, the projectile adapter will be removed, and the Auxiliary Detonating Fuze Mk 54 will be employed, replacing the previously used Auxiliary Detonating Fuzes Mk 17 and Mk 46.

When the V.T. Fuze Mk 53 is used, the projectile adapter is removed and the Auxiliary Detonating Fuze Mk 44 employed.

This projectile is also issued B.L. & P. or B.L. & T. with an adapter and the Tracer Mk 6, or Cut-off Base Fuze Mk 13, for target practice.

5-inch A.A. Common Mk 34 Mod 10

Guns used in.......................5"/38
Over-all length, inches
With nose fuze.....................20.7
Without nose fuze..................17.2
Diameter of base, inches..............4.97
Distance base to band, inches..........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches.........4.985
Filling...................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....55.18
Charge/weight ratio 13.33%
Cartridge Case......................Mk 5
Primer................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes
Base.....Mk 28 and all Mods
Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 Mods 0–4 (M.T.F.)
Mk 29 Mods 2 and 3 (P.D.F.)
Mk 32 and all Mods (V.T.F.)
Mk 40 and all Mods (V.T.F.)
Mk 63 Mod 0 (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 46 Mod 0
Mk 54 Mods 0 and 1

This projectile consists of a Projectile Mk 31 Mod 10 modified to receive a Base Fuze Mk 28.

The Auxiliary Detonating Fuze Mk 54 is replacing the Auxiliary Detonating Fuzes Mk 17

and Mk 46 in all assemblies.

The V.T. Fuze Mk 40 and its Mods are replacing the Mk 32 and Mods. When these fuzes are used in this projectile, no base fuze or tracer is employed. The projectile adapter is removed, and a gas-checked fuze-hole plug is fitted in the base.

5-inch A.A. Common Mk 35 Mods 1—12

Guns used in.................5"/38 (case)
5"/51 (bag)
Over-all length, inches
With nose fuze....................20.70
Without nose fuze................17.225
Diameter of base, inches..............4.973
Distance base to band, inches..........2.43
Width of band, inches.................2.25
Diameter at bourrelet, inches.........4.985
Filling...................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....55.18
Charge/weight ratio 13.1%
Cartridge Case ....Mk 5
Primer................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes
Base.....Mk 28 and all Mods
Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 and all Mods (M.T.F.)
Mk 61 Mod 0 (M.T.F.) (See below.)
Mk 29 Mods 2 and 3 (P.D.F.)
Mk 32 and all Mods (V.T.F.)
Mk 40 and all Mods (V.T.F.)
Mk 53 and all Mods (V.T.F.)
Mk 63 Mod 0 (M.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 44 Mods 0 and 1
Mk 46 Mod 0
Mk 54 Mods 0 and 1

The Nose Fuze Mk 40 is replacing the Mk 32 when used in the 5"/38 gun. With the 5"/51 bag gun, however, Nose Fuze Mk 32 Mod 40, rather than the Nose Fuze Mk 40, is employed. When these fuzes are used, the projectile adapter is removed, a gas-checked base fuze plug, with no tracer, is fitted into the base, and

Figure 36. 5-inch A.A. Common Mk 35 Mods 1—12

the Auxiliary Detonating Fuze Mk 54 is employed.

When the V.T. Fuze Mk 53 is used, the base is fitted with a gas-checked base-fuze plug, with no tracer, the projectile adapter is removed, and the Auxiliary Detonating Fuze Mk 44 is employed.

The Auxiliary Detonating Fuze Mk 54 is replacing the Fuzes Mk 17 and Mk 46 in all assemblies.

With the 1200 f/s I.V. reduced charge for the 5"/38 gun, Nose Fuzes Mk 61 and Mk 29 Mods 2 and 3 with the Auxiliary Detonating Fuze Mk 54 will be employed.

All Mods of this projectile, except Mod 6, may be issued B.L. & P. or B.L. & T. with the Tracer Mk 9 and adapter for target practice.

When these projectiles are used in the 5"/51 bag gun, the Primer Mk 15 Mod 1 is used.

5-inch A.A. Common Mk 36 Mods 1—4

Guns used in.......................5"/25
Over-all length, inches
With nose fuze....................20.70
Without nose fuze................17.225
Diameter of base....................4.973
Distance base to band, inches...........2.43
Width of band, inches.................2.00

Diameter at bourrelet, inches..........4.985
Filling....................Exp. D, Comp. A
Weight of filling, pounds..............7.25
Weight of loaded projectile, pounds....53.85
Charge/weight ratio 13.5%
Cartridge Case...........Mk 4, Mk 4 Mod 2
Primer.................Mk 13 and all Mods
Tracer ....Mk 9
Fuzes
  Base.....Mk 28 and all Mods
  Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
    Mk 50 and all Mods (M.T.F.)
    Mk 29 Mods 1, 2, and 3 (P.D.F.)
    Mk 32 and all Mods (V.T.F.)
    Mk 40 and all Mods (V.T.F.)
    Mk 53 and all Mods (V.T.F.)
    Mk 63 Mod 0 (M.T.F.)
  Auxiliary Detonating Fuze
    Mk 17 and all Mods
    Mk 46 Mod 0
    Mk 44 Mod 0 and 1
    Mk 54 Mod 0

When the V.T. fuzes are used, the projectile adapter is removed, and a gas-checked base-fuze plug, with no tracer, is fitted into the base.

V.T. fuzes are authorized for use in Mods 2–4 only of this projectile.

The Auxiliary Detonating Fuze Mk 54 is replacing the Auxiliary Detonating Fuzes Mk 17 and the Mk 46. The Auxiliary Detonating Fuze Mk 44 is used only in conjunction with the V.T. Fuze Mk 53.

All Mods of the Projectile Mk 36 are authorized for use with A.P. steel nose caps and for designation as "H.C." projectiles.

All Mods of the Projectile Mk 36 may also be issued B.L. & P. or B.L. & T. with the Tracer Mk 9 and adapter for target practice.

5-inch A.A. Common Mk 47 Mods 0 and 1

Guns used in........................5″/38
Over-all length, inches
  With nose fuze.....................20.70
  Without nose fuze..................52.43
Diameter of base, inches..............4.985
Distance base to band, inches..........1.93
Width of band, inches..................2.25
Diameter at bourrelet, inches..........4.985
Filling ....Explosive D
Weight of filling, pounds..............7.11
Weight of loaded projectile, pounds....55.18
Charge/weight ratio 7.7%
Cartridge Case ....Mk 5
Primer....................Mk 13, all Mods
Tracer ....Mk 9
Fuzes.....................Same as Mk 35

The Mod 1 differs from the Mod 0 in that the band seat has different knurling.

Only a few thousand of these A.A. Common Projectiles Mk 47 were made.

The Mk 47 was made to furnish a heavier projectile for some newer light-weight fuzes, hence maintaining a standard ballistic weight. However, it has been fuzed exactly like the Mk 35 up to the present time.

5-inch Illuminating Mk 25
(a) Mods 1, 3, 4, 5, 6
(b) Mod 2 (Obsolete)

Guns used in......(a) 5″/51 (bag or case)
  (b) 5″/25 (case)
Over-all length, inches
  With nose fuze....................19.975
  Without nose fuze.................15.865
Diameter of base, inches..............4.948
Distance base to band, inches...........2.43
Width of band, inches...................2.0
Diameter at bourrelet, inches.........4.985
Filling.......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....54.5
Cartridge Case ...... (a) Mk 3
  (b) Mk 4, Mk 4 Mod 3
Primer.................Mk 13 and all Mods
Fuzes
  Nose..............Mk 18 Mods 2, 3, and 4
    Mk 50 and all Mods
    Mk 63 Mod 0

The Mod 2 projectile, used in the 5″/25 gun, is identical to the Mod 1, except for modification of the rotating band.

When these projectiles are used in the 5″/51 bag gun, the Primer Mk 15 Mod 1 is used, and the Nose Fuzes Mk 50 and Mk 63 may be employed.

Use of the Nose Fuzes Mk 50 and Mk 63 is not authorized with rounds used in the 5"/25 and 5"/51 case guns.

The Illuminating Contents Mk 3 are used with projectiles Mods 1 through 4; projectiles Mods 5 and 6 are assembled with Illuminating Contents Mk 4 Mod 5 when used in the 5"/51 bag gun, Illuminating Contents Mk 3 when used in the 51"/51 case gun.

5-inch Illuminating and 5-inch W.P. Mk 27 Mods 1—10

Guns used in........................5"/25
Over-all length, inches
With nose fuze.....................20.0
Without nose fuze..................15.8
Diameter of base, inches...............4.968
Distance base to band, inches...........1.93
Width of band, inches..................2.00
Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile
53.65 pounds — Mods 1–4
54.50 pounds — Mods 5–10
Cartridge Case ....Mk 4, Mk 4 Mod 2
Primer.................Mk 13 and all Mods
Fuzes
Nose.................Mk 63 Mod 0
Mk 18 Mods 2, 3, 4
Mk 50 and all Mods

Mods 1, 2, 3, 4 have a band diameter of 5.10 inches, and Mods 5, 6, 7, 8, 9, and 10 have a band diameter of 5.12 inches.

The Illuminating Contents Mk 4 Mod 5 are used in this projectile.

The 5-inch W.P. projectile utilizes the Mk 27 body with incendiary contents.

5-inch Illuminating Mk 30 Mods 1—8

Guns used in........................5"/38
Over-all length, inches
With nose fuze.....................20.0
Without nose fuze..................15.8
Diameter of base, inches...............4.968
Distance base to band, inches...........2.43
Width of band, inches..................2.25

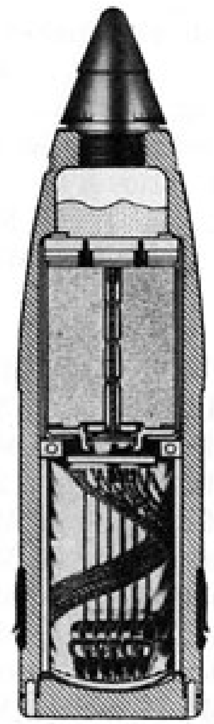


Figure 37. 5-inch Illuminating Mk 30 Mods 1—8

Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds.....54.5
Cartridge Case ....Mk 5
Primer.................Mk 13 and all Mods
Fuzes
Nose.................Mk 63 Mod 0
Mk 18 Mods 2, 3, 4
Mk 50 and all Mods

The Illuminating Contents Mk 4 Mod 5 are used in this projectile.

5-inch Illuminating Mk 43 Mod 0

Guns used in........................5"/54
Over-all length, inches................26.0
Without nose fuze..................22.28
Diameter of base, inches...............4.973
Diameter at bourrelet, inches..........4.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds......70
Cartridge Case ....Mk 6

Primer. . . . . .Mk 13 and all Mods
Fuzes. . . . . .Nose—Mk 25 Mod 1

The Illuminating Contents Mk 4 Mod 5 are used in this projectile, modified to use a lengthened spacer sleeve.

This projectile is identical to the 5-inch Illuminating Projectile Mk 48, except that the latter has a double rotating band.

5-inch Illuminating Mk 44 Mod 1

Guns used in. . . . . .5″/38
Over-all length, inches
With nose fuze. .19.97
Without nose fuze. 16.465
Diameter of base, inches. 4.973
Distance base to band, inches. 2.43
Width of band, inches. 2.25
Diameter at bourrelet, inches. 4.985
Filling . . . . . .Expelling charge is black powder; flare, magnesium.
Weight of filling. . . .Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds. 54.5
Cartridge Case . . . . .Mk 5
Primer. . . . . .Mk 13 and all Mods
Fuzes
Nose. . . . . .Mk 18 Mods 2, 3, and 4
Mk 50 Mods 0–4
Mk 63 Mod 0

This projectile is currently assembled with the Illuminating Contents Mk 4 Mod 5

5-inch Illuminating and 5-inch W.P. Mk 45 Mod 0

Guns used in. . . . . .5″/25
Over-all length, inches
With nose fuze. .19.97
Without nose fuze. 16.465
Diameter of base, inches. 4.968
Distance base to band, inches. 1.93
Width of band, inches. 2.0
Diameter at bourrelet, inches. 4.985
Filling . . . . . .Expelling charge is black powder; flare, magnesium.
Weight of filling. . . .Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds. 54.5
Cartridge Case. . . . . .Mk 4, Mk 4 Mod 2
Primer. . . . . .Mk 13 and all Mods
Fuzes
Nose. . . . . .Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Mk 63 Mod 0

This projectile is loaded with the Illuminating Contents Mk 4 Mod 5.

The W.P. projectile uses the body of the Mk 45 and the incendiary contents of the W.P. shell.

5-inch Illuminating Mk 48 Mod 0

Guns used in. . . . . .5″/54
Over-all length, inches. 26.0
Without nose fuze. 22.28
Diameter of base, inches. 4.973
Diameter at bourrelet, inches. 4.985
Filling . . . . . .Expelling charge is black powder; flare, magnesium.
Weight of filling. . . .Expelling charge is 2.5 ounces.

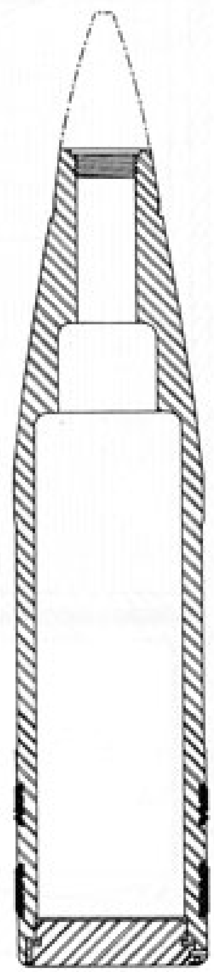


Figure 38. 5–inch Illuminating Mk 48 Mod 0

Weight of loaded projectile, pounds......70
Cartridge Case......................Mk 6
Primer..................Mk 13 and all Mods
Fuzes..................Nose—Mk 25 Mod 1

The Illuminating Contents Mk 4 Mod 5 are used, modified for a lengthened spacer sleeve.

The projectile is identical in all respects to the Mk 43, except that it has a double rotating band.

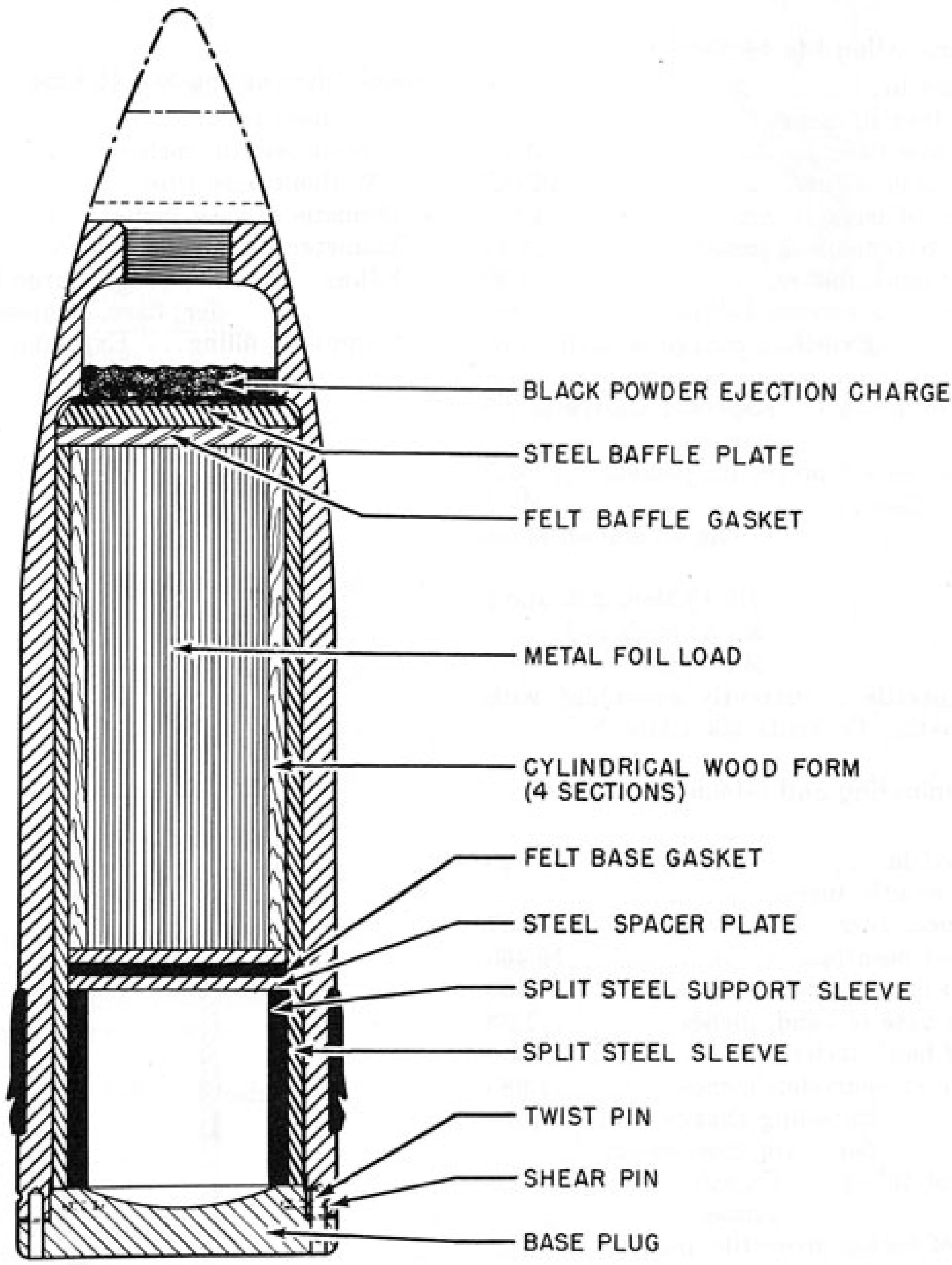


Figure 39. 5-inch Window Projectile—Window Load Mk 1 Mod 1

5-inch Window Projectile

Guns used in	5"/38
Over-all length, inches	
With nose fuze	20.0
Without nose fuze	15.8
Diameter of base, inches	4.968
Distance base to band, inches	2.43
Width of band, inches	2.25
Diameter at bourrelet, inches	4.985

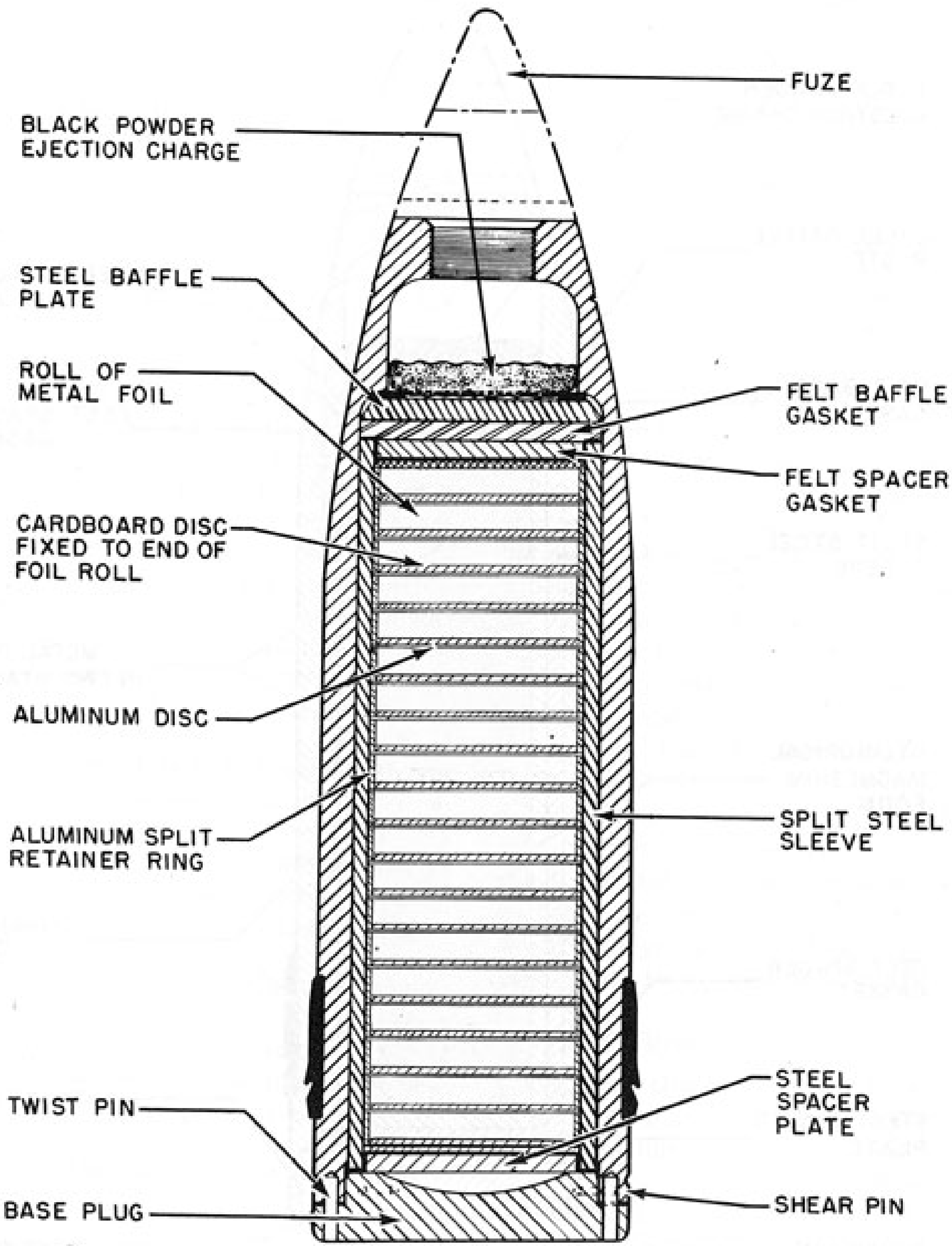


Figure 40. Window Load Mk 2 Mod 0

Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 2.5 ounces.

Weight of loaded projectile, pounds
Load Mk 1 Mod 1—53.9 (approx.)
Load Mk 2 Mod 0—54.6 (approx.)
Load Mk 4 Mod 0—53.0 (approx.)

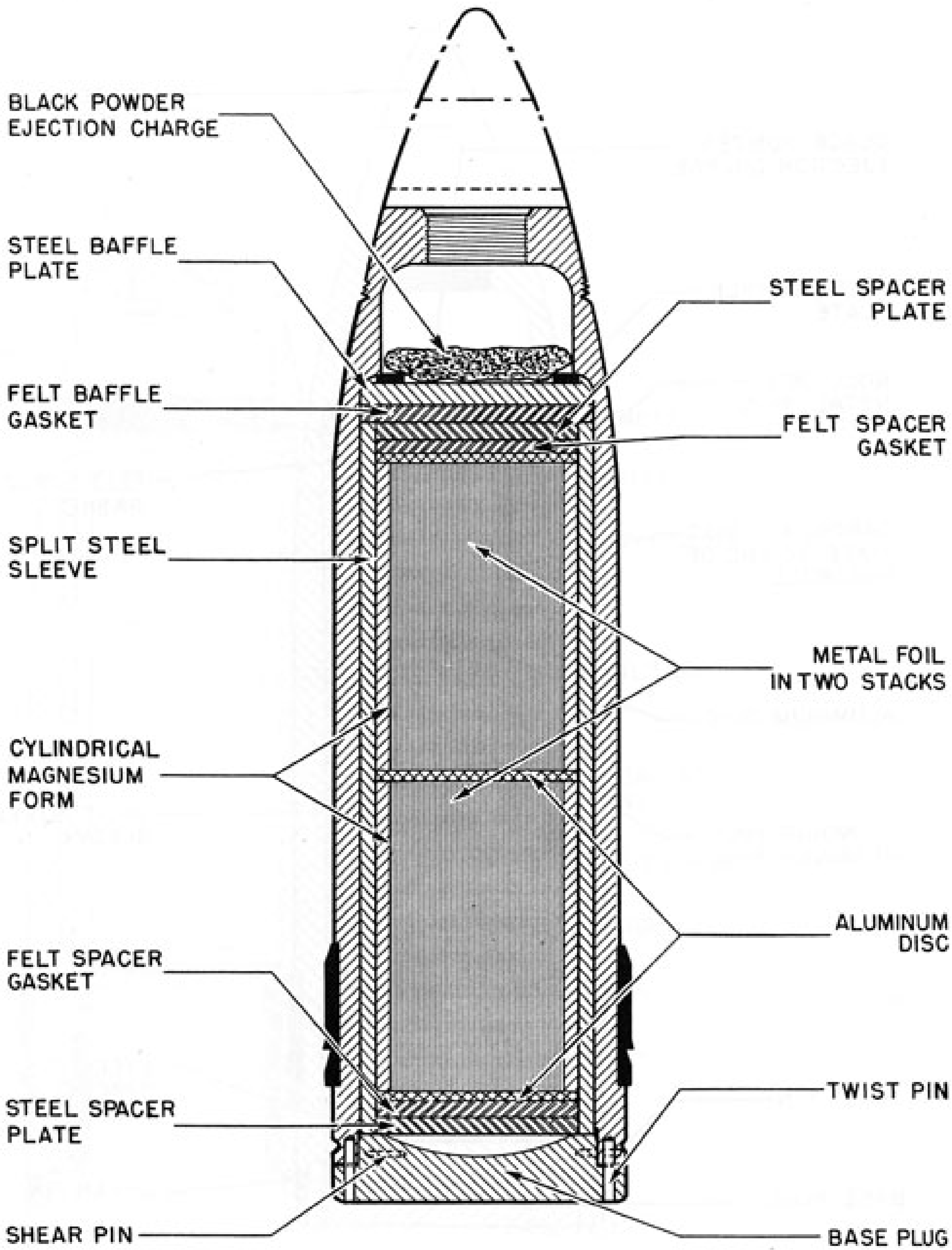


Figure 41. Window Load Mk 4 Mod 0

Cartridge Case . . . . Mk 5
Primer . . . . Mk 13 and all Mods
Fuzes
Nose . . . . Mk 63 Mod 0
Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Projectile Body
5-inch Ill. Mk 30 Mods 5, 7, and 8
5-inch Ill. Mk 44 Mod 1

Window Load Mk 1 Mod 1: Consists of about 13,800 aluminum foil strips, each 8 inches long, 3/16 inch wide, and 0.00035 inch thick, backed on either side by 12 pounds of tissue paper, solid glued. The strips are stacked within a four-section cylindrical wood form, which is encased in a split steel sleeve, the whole inserted into the projectile cavity.

Window Load Mk 2 Mod 0: Consists of 19 rolls of aluminum foil stacked within a split steel sleeve. Each roll contains continuous foil 600 feet long, ½ inch wide, and 0.0009 inch thick. One end of the foil is attached to a cardboard disc by a rayon leader 15 feet long, insuring streaming out of the foil roll. The foil rolls, with their cardboard discs, are each encased in a split retainer ring, forming a load unit. The units are separated by aluminum discs when loaded in the split steel sleeve.

Window Load Mk 4 Mod 0: Consists of two stacks of 13,800 aluminum foil strips, each stack separated by an aluminum disc. Each strip is 5.1 inches long by 3/16 in. wide. The strips are stacked within two four-section cylindrical magnesium forms, which are encased in a split steel sleeve.

Operation: The explosion of the black powder ejection charge, initiated by the fuze, exerts a pressure against the baffle plate and forces the split steel sleeve, window load, and base plug out of the base end of the projectile.

5-inch White Phosphorus Smoke Projectile

Guns used in . . . . 5"/38
Over-all length, inches
With nose fuze 20.0
Without nose fuze 15.8
Diameter of base, inches 4.968
Distance base to band, inches 2.43
Width of band, inches 2.25
Diameter at bourrelet, inches 4.985
Filling . . . . . . Expelling charge is black powder; flare, magnesium.
Weight of filling . . . . Expelling charge is 2.5 ounces.
Weight of loaded projectile, pounds 53.0
Cartridge Case . . . . Mk 5
Primer . . . . Mk 13 and all Mods
Fuzes
Nose . . . . . . Mk 63 Mod 0 (M.T.F.)
Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 and Mods (M.T.F.)
Mk 29 Mod 3 (P.D.F.)
Mk 61 Mod 0 (M.T.F.)—for use with 1,200 f/s initial velocity reduced charge
Mk 66 Mod 0 (P.D.F.)
Projectile Body
5-inch Illuminating Mk 30 Mods 1–8

The projectile body, base plate, and expelling charge are the same as those for the 5-inch Illuminating Projectile Mk 30.

The canister holding the W.P. filled tubes is of 0.03-inch thick sheet steel and measures 12.03 inches long by 3.9 inches in diameter. It is painted olive drab over all. Through the center of the canister is inserted a burster tube containing the ballistite burster charge, with a black powder delay fitted to the upper end of the tube. The canister is divided into four sections internally, with each section containing 42 W.P. filled steel tubes 0.5 inch in diameter and 2.86 inches long, 168 tubes in all. The canister is filled through the base with molten W.P. and closed with two ½-inch pipe plugs.

Type of Filling

Expelling charge . . . . . . 2 ounces black powder
Bursting charge . . . . 14 grams Ballistite
Smoke filling . . . . 7.06 pounds white phosphorus

The black powder expelling charge, ignited by the fuze, initiates the delay element at the upper end of the burster tube and forces off the base plate, ejecting the canister rearward. The

delay initiates the burster, which ruptures the canister and scatters the W.P. filled steel tubes. The smoke cloud thus formed is about 30–40 yards in diameter. The projectile combines screening, anti-personnel, and slight incendiary effect.

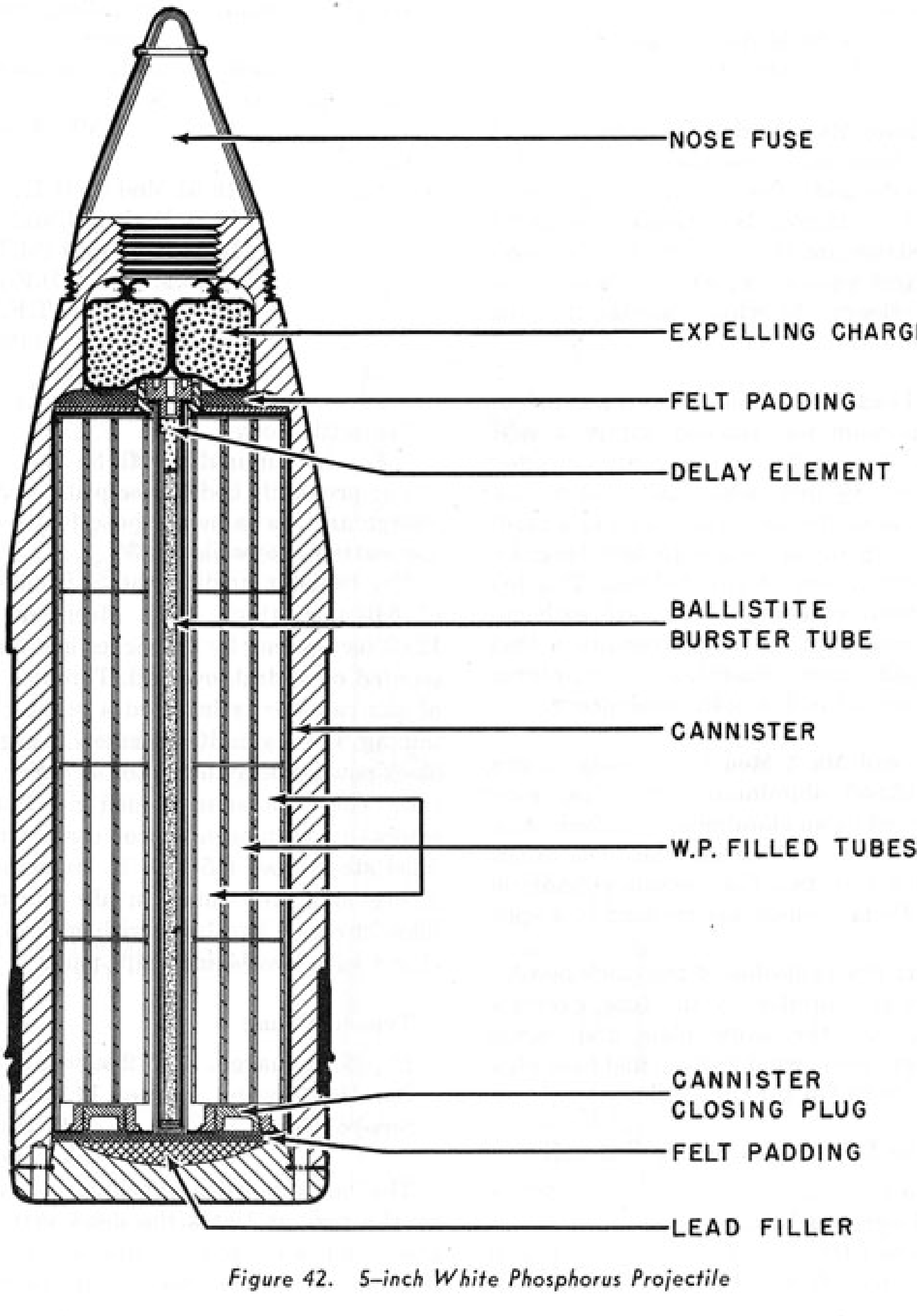


Figure 42. 5-inch White Phosphorus Projectile

6-INCH PROJECTILES

6-inch A.P. Mk 35 Mods 1—11

Guns used in	6"/47 (case)
Over-all length, inches	
With cap and windshield	27.0
Without cap and windshield	17.19
Diameter of base, inches	5.985
Distance base to band, inches	1.55
Width of band, inches	2.50
Diameter at bourrelet, inches	5.985
Filling	Explosive D
Weight of filling, pounds	1.95
Weight of loaded projectile, pounds	130
Charge/weight ratio	1.5%
Cartridge Case	Mk 4
Primer	Mk 13 and all Mods
Tracer	Mk 5
Fuzes	Base—Mk 21 Mods 0 and 1

6-inch Special Common Mk 27 Mods 1—8

Guns used in	6"/53
Over-all length, inches	
With cap and windshield	27.0
Without cap and windshield	15.95
Diameter of base, inches	5.985
Distance base to band, inches	1.55
Width of band, inches	2.50
Diameter at bourrelet, inches	5.985
Filling	Explosive D
Weight of filling, pounds	2.20
Weight of loaded projectile, pounds	105
Charge/weight ratio	2.1%
Primer	Mk 15 Mod 1
Tracer	Mk 5
Fuzes	Base—Mk 19 Mods 0 and 1

The 6-inch Special Common Projectiles Mk 27 Mods 2 and 5 have 2.50 pounds of explosive, rather than the 2.20 pounds contained in the other Mods.

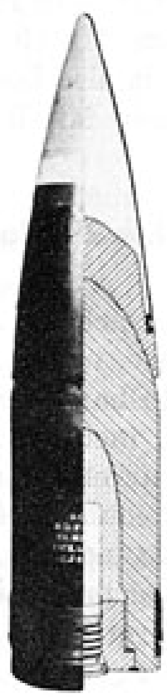


Figure 43. 6–inch A.P. Mk 35 Mods 1—8

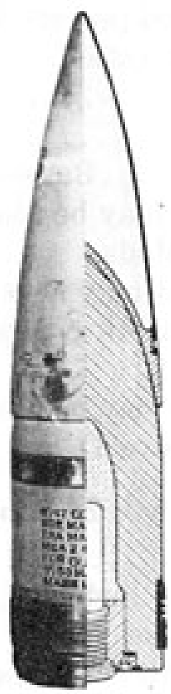


Figure 44. 6–inch Special Common Mk 27 Mods 1—8

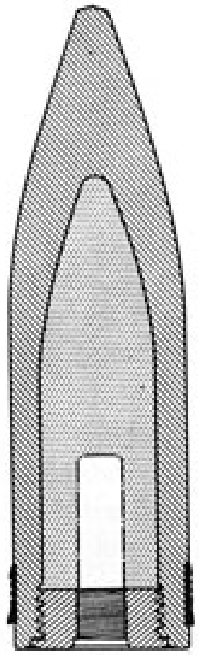


Figure 45. 6-inch Common Mk 20 Mods 0—4

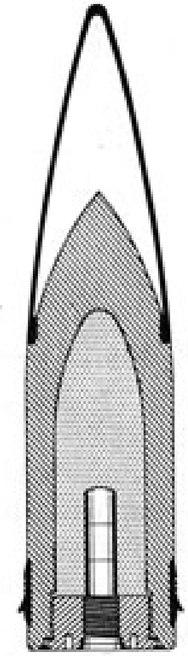


Figure 46. 6-inch Common Mk 24 Mod 1

6-inch Common Mk 20 Mods 0—4 (Obsolete)

Guns used in......................6"/50
Over-all length, inches...............22.70
Diameter of base, inches...............5.94
Distance base to band, inches...........1.0
Width of band, inches.................2.0
Diameter at bourrelet, inches..........5.985
Filling.......................Explosive D
Weight of filling, pounds..............7.08
Weight of loaded projectile, pounds......105
Charge/weight ratio 5.97%
Primer......................Mk 15 Mod 1
Tracer ....Mk 5
Fuzes...........Base—Mk 28 and all Mods

This projectile may be found fuzed with Base Fuze Mk 3 and Mods.

Mods 0, 2, and 4 may also be issued B.L. & T. with adapter and Mk 5 Mod 1 Tracer for target practice.

This projectile may be found loaded with 6.25 pounds of Explosive D.

6-inch Common Mk 24 Mods 1—5

Guns used in......................6"/53
Over-all length, inches...............27.0
Diameter of base, inches.............5.985
Distance base to band, inches...........1.0
Width of band, inches.................2.50
Diameter at bourrelet, inches..........5.985
Filling ....Explosive D
Weight of filling, pounds..............5.73
Weight of loaded projectile, pounds.....105
Charge/weight ratio 5.46%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes..........Base—Mk 19 Mods 0 and 1

This projectile is reserved for submarines.

This projectile may be fuzed with Base Fuzes Mk 3 and Mods. It is to be reloaded and refuzed with the Base Fuze Mk 19.

This projectile is also issued B.L. & T. with adapter and Tracer Mk 5 Mod 1 for target practice.

6-inch Common Mk 28 Mods 1 and 2

Guns used in.................6"/47 (bag)
Over-all length, inches................27.0
Diameter of base, inches.............5.985
Distance base to band, inches..........1.55
Width of band, inches................2.50
Diameter at bourrelet, inches.........5.985
Filling ....Explosive D
Weight of filling, pounds.............5.72
Weight of loaded projectile, pounds.....105
Charge/weight ratio 5.45%
Primer ....Mk 15 Mod 1
Tracer............................Mk 5
Fuzes ....Base—Mk 19 Mods 0 and 1

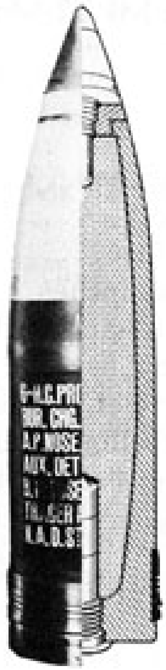


Figure 47. 6–inch H.C. Mk 34 Mods 1—7

6-inch H.C. Mk 34 Mods 1—7

Guns used in . . . . 6″/47 (case)
6″/53 (bag)
Over-all length, inches
With nose fuze 27.045
Without nose fuze 22.225
Diameter of base, inches 5.985
Distance base to band, inches 1.55
Width of band, inches 2.50
Diameter at bourrelet, inches 5.985
Filling . . . . Explosive D
Weight of filling, pounds 13.22
Weight of loaded projectile, pounds 105
Charge/weight ratio 12.6%
Cartridge Case . . . . Mk 4
Primer . . . . Mk 13 and all Mods
Tracer . . . . Mk 5, Mk 5 Mod 1
Fuzes
Base . . . . . . Mk 28 Mods 0 and 1
Nose . . . . . . Mk 29 Mods 2 and 3 (P.D.F.)
Steel nose plug
Mk 18 Mods 2, 3, and 4 (M.T.F.)
Mk 50 and all Mods (M.T.F.)
Mk 63 Mod 0 (M.T.F.)
Mk 47 Mod 0 (V.T.F.)
Auxiliary Detonating Fuze
Mk 17 and all Mods
Mk 46 Mod 0
Mk 54 Mods 0 and 1
Mk 44 Mods 0 and 1

A nose cap may be threaded to the projectile body over the nose fuze for moisture-proofing purposes.

When this projectile is used in the 6″/53 bag gun, the Primer Mk 15 Mod 1 is used.

The Auxiliary Detonating Fuze Mk 54 is replacing the Auxiliary Detonating Fuzes Mk 17 and Mk 46 in all assemblies.

A specially cavitized Mk 34 round, designed for use in the 6″/47 gun only, is being produced for assembly with the V.T. Fuze Mk 47. When this fuze is used, the Base Fuze Mk 28 is also employed, without tracer. This feature differs from other V.T. fuzed projectiles, which take no base fuze. The Auxiliary Detonating Fuze Mk 44 will be used only in conjunction with the V.T. Fuze Mk 47.

6-inch H.C., W.P., Illuminating, and Window Mk 39 Mod 0

Guns used in . . . . 6″/47 Dual-purpose

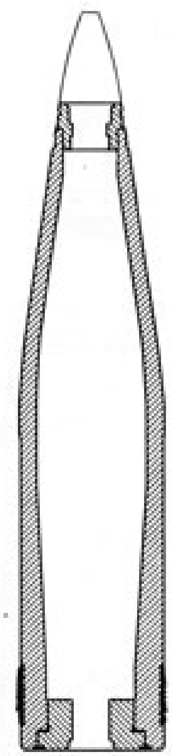


Figure 48. 6–inch H.C. W.P., Illuminating, and Window Mk 39 Mod 0

Over-all length, inches
With nose fuze.......................30
Without nose fuze.................26.28
Diameter of base, inches..............5.985
Distance base to band, inches...........1.00
Width of band, inches.................2.5
Diameter at bourrelet, inches.........5.985
Filling.......................Explosive D
Weight of filling, pounds..............14.09
Weight of loaded projectile, pounds......105
Cartridge Case......................Mk 4
Primer....................Mk 13, all Mods
Tracer.................Mk 5, Mods 0 and 1
Fuzes
Base.....Mk 28 Mods 0 and 1
Nose.....Mk 25 (M.T.F.)
Mk 30 (P.D.F.)
Mk 47 (V.T.F.)
Auxiliary Detonating Fuze
Mk 43
Mk 44 (with V.T.F.)

This is the H.C. round designed for the new 6"/47 dual-purpose gun. It is a half-caliber longer than the 6-inch H.C. Projectile Mk 34, and will be adaptable for loading of H.C., W.P., Illuminating, or Window fillers.

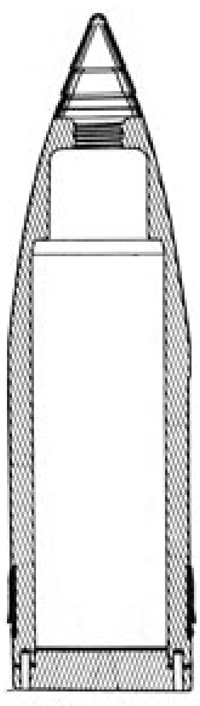


Figure 49. 6–inch Illuminating Mk 22 Mod 1

6-inch Illuminating Mk 22 Mod 1 (Obsolete)

Guns used in ....6"/47 (bag)
6"/50 (bag)
6"/53 (bag)
Over-all length, inches
With nose fuze 23.027
Without nose fuze................18.697
Diameter of base, inches..............5.94
Distance—base to band, inches.........2.35
Width of band, inches.................2.50
Diameter at bourrelet, inches..........5.985
Filling ......Expelling charge of black powder; flare, magnesium.
Weight of filling....Expelling charge is 3.5 ounces.
Weight of loaded projectile, pounds....95.40
Primer ....Mk 15 Mod 1
Fuzes
Nose.....Mk 63 Mod 0
Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods

The Nose Fuze Mk 50 is authorized for assembly in this projectile only when used in the 6"/53 bag gun.

The Illuminating Contents Mk 3 are used in this round.

6-inch Illuminating Mk 23 Mods 1 and 2

Guns used in ....6"/47 (bag)
6"/50 (bag)
6"/53 (bag)
Over-all length, inches
With nose fuze 23.027
Without nose fuze................18.697
Diameter of base, inches..............5.94
Distance base to band, inches..........2.35
Width of band, inches.................2.50
Diameter at bourrelet, inches.........5.985
Filling ......Expelling charge is black powder; flare, magnesium.
Weight of filling....Expelling charge is 3.5 ounces.
Weight of loaded projectile, pounds.....96.0
Primer ....Mk 15 Mod 1
Fuzes
Nose.....Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Mk 63 Mod 0

The Nose Fuzes Mk 50 and Mk 63 are authorized for assembly in this projectile only when used in the 6"/53 bag gun.

The Illuminating Contents Mk 3 are used.

6-inch Illuminating Mk 32 Mod 0

Guns used in . . . . 6"/47 (case)
Over-all length, inches
With nose fuze 23.027
Without nose fuze 19.517
Diameter of base, inches 5.94
Distance base to band, inches 2.05
Width of band, inches 2.50
Diameter at bourrelet, inches 5.985
Filling . . . . . . Expelling charge is black powder; flare, magnesium.
Weight of filling . . . . Expelling charge is 3.5 ounces.
Weight of loaded projectile, pounds 94.5
Cartridge Case . . . . Mk 4
Primer . . . . Mk 13 and all Mods
Fuzes
Nose . . . . . Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Mk 63 Mod 0

The Illuminating Contents Mk 4 Mod 6 are used in this projectile.

6-inch Illuminating Mk 38 Mod 0

Guns used in . . . . 6"/47 (case)
Over-all length, inches
With nose fuze 26.7
Without nose fuze 23.225
Diameter of base, inches 5.975
Distance base to band, inches 1.0
Width of band, inches 2.50
Diameter at bourrelet, inches 5.985
Filling . . . . . . Expelling charge is black powder; flare, magnesium.
Weight of loaded projectile, pounds 105
Cartridge Case . . . . Mk 4
Primer . . . . Mk 13 and all Mods
Fuzes
Nose . . . . . Mk 18 Mods 2, 3, and 4
Mk 50 and all Mods
Mk 63 Mod 0

This projectile was made to provide an illuminating projectile similar in ballistic traits to the 6" H.C. Projectile Mk 34.

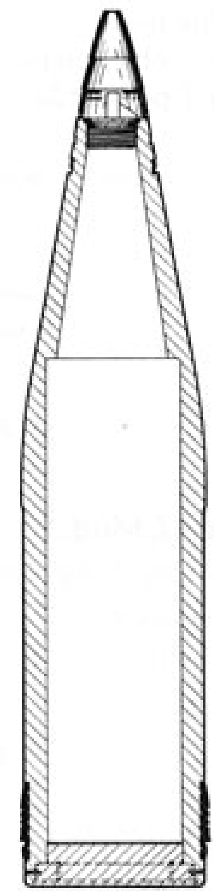


Figure 50. 6–inch Illuminating Mk 41 Mod 0

6-inch Illuminating Mk 41 Mod 0

Guns used in . . . . 6"/47 Dual-purpose
Over-all length, inches 30.00
Without nose fuze 26.28
Diameter of base, inches 5.975
Distance base to band, inches 1.00
Width of band, inches 2.50
Diameter at bourrelet, inches 5.985
Type of filling . . Black powder ejection charge
Weight of filling, ounces 2.5
Weight of loaded projectile, pounds 110.0
Cartridge Case . . . . Mk 4
Primer . . . . Mk 13, all Mods
Fuzes . . . . Nose—Mk 25 (M.T.F.)

The Illuminating Contents Mk 4 Mod 6 are used in this projectile.

6-inch Target Mk 36 Mods 1, 2, and 3

Guns used in . . . . 6"/47 (case)
Over-all length, inches 27
Diameter of base, inches 5.985
Distance base to band, inches 1.0

Width of band, inches....................2.5
Diameter at bourrelet, inches..........5.985
Weight of loaded projectile, pounds.....130
Cartridge Case.........................Mk 4
Primer...................Mk 13 and all Mods
Tracer.........................Mk 5 Mod 1

This projectile has no spotting dye loaded in the windshield.

The different modifications are to distinguish between manufacturers.

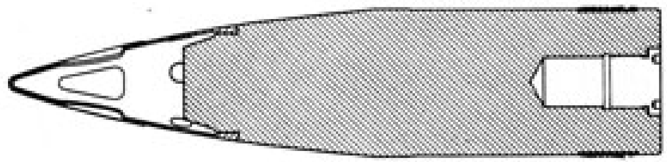


Figure 51. 6–inch Target Mk 37 Mod 1

6-inch Target Mk 37 Mod I

The only difference between this projectile and the 6-inch Mk 36 target round is that the Mk 37 has provision for a spotting dye load.

Part I — Chapter I — Section 6

7-INCH PROJECTILES

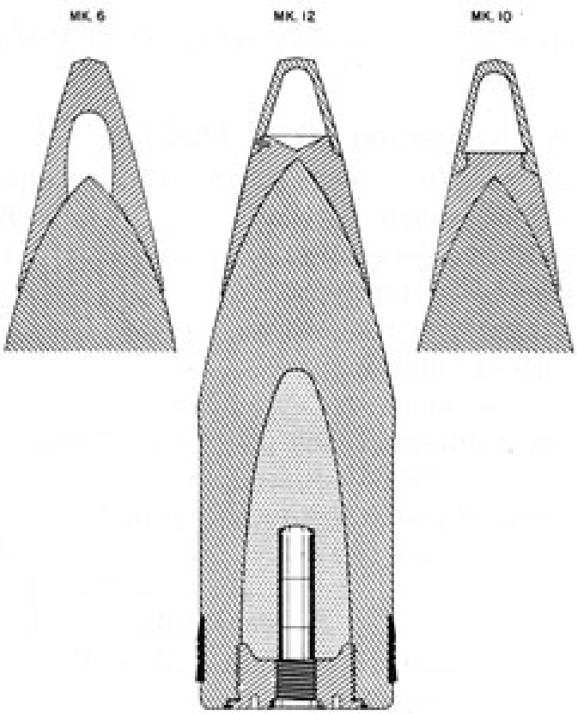


Figure 52. 7–inch A.P. Mks 6, 10, and 12

7-inch A.P. Mk 6 Mod I (Obsolete)

Guns used in........................7″/45
Over-all length, inches
  With cap & Windshield..............23.64
  Without cap & windshield...........19.79
Diameter of base, inches..............6.94
Distance base to band, inches..........1.0
Width of band, inches.................2.33
Diameter at bourrelet, inches.........6.99
Filling.......................Explosive D
Weight of filling, pounds.............4.31
Weight of loaded projectile, pounds.....165
Charge/weight ratio..................2.61%
Primer.......................Mk 15 Mod 1
Tracer.............Integral in fuze; Mk 5
Fuzes
  Base.......Mk 2 Mod 2 (B.I.F.)
             Mk 9 (B.I.F.)
             Mk 21 Mods 0 and 1 (B.D.F.)

The 7″/45 gun is obsolete. This is an old type projectile, without windshield, which is not in common use.

7-inch A.P. Mk 10 Mod 2 (Obsolete)

Guns used in ....7"/45
Over-all length, inches 23.73
Diameter of base, inches 6.94
Distance base to band, inch 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.99
Filling .... Explosive D
Weight of filling, pounds 4.31
Weight of loaded projectile, pounds 165
Charge/weight ratio 2.61%
Primer ....Mk 15 Mod 1
Tracer ....Integral in fuze; Mk 5
Fuzes
Base.......Mk 2 Mod 2 (B.I.F.)
Mk 9 (B.I.F.)
Mk 21 Mods 0 and 1 (B.D.F.)

7-inch A.P. Mk 12 Mods 1 and 2 (Obsolete)

Guns used in........................7"/45
Over-all length, inches 23.68
Diameter of base, inches 6.94
Distance base to band, inches 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.985
Filling ....Explosive D
Weight of filling, pounds ....Mk 1—4.0
Mk 2—3.5
Weight of loaded projectile, pounds 165
Primer ....Mk 15 Mod 1
Tracer ....Integral in fuze; Mk 5
Fuzes
Base.......Mk 2 Mod 2 (B.I.F.)
Mk 9 (B.I.F.)
Mk 21 Mods 0 and 1 (B.D.F.)

7-inch Field Mk 13 Mods 1 and 2 (Obsolete)

Guns used in........................7"/45
Over-all length, inches
With nose fuze 29.58
Without nose fuze..................28.0
Diameter of base, inches 6.94
Distance base to band, inches 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.985
Filling ....Cast TNT
Weight of filling, pounds 24
Weight of loaded projectile, pounds 152
Charge/weight ratio 15.1%
Primer ....Mk 15 Mod 1
Fuzes..........Nose—Mk 7 Mod 1 (P.D.F.)

7-inch Bombardment Mk 14 Mod 2 (Obsolete)

Guns used in........................7"/45
Over-all length, inches
With nose fuze....................28.84
Without nose fuze..................24.80
Diameter of base, inches 6.94
Distance base to band, inches 1.0
Width of band, inches 2.33
Diameter at bourrelet, inches 6.985
Filling ....Cast TNT
Weight of filling, pounds 24
Weight of loaded projectile, pounds 153.8
Charge/weight ratio................15.6%
Primer ....Mk 15 Mod 1
Tracer ....Mk 9
Fuzes
Nose...............Mk 7 Mod 1 (P.D.F.)
Base...............Mk 3 Mod 2
Mk 28 Mods 0 and 1

The bombardment projectile's shape is similar to that of the field projectile.

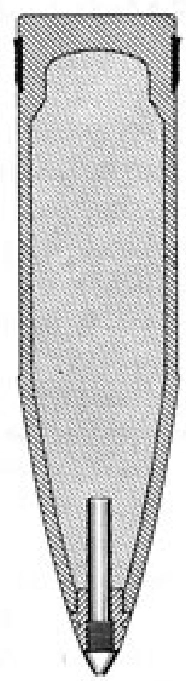


Figure 53. 7–inch Field Mk 13 Mods 1 and 2

8-INCH PROJECTILES

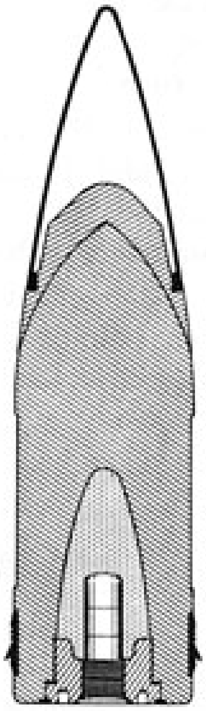


Figure 54. 8–inch A.P. Mk 19 Mods 1—6

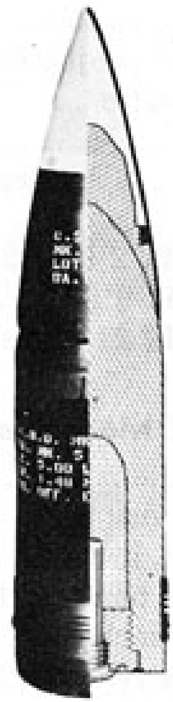


Figure 55. 8–inch A.P. Mk 21 Mods 1—5

8-inch A.P. Mk 19 Mods 1—6

Guns used in	8″/55
Over-all length, inches	
With cap and windshield	36.0
Without cap and windshield	19.4
Diameter of base, inches	7.977
Distance base to band, inches	2.56
Width of band, inches	3.30
Diameter at bourrelet, inches	7.977
Filling	Explosive D
Weight of filling, pounds	3.64
Weight of loaded projectile, pounds	260
Charge/weight ratio	1.4%
Primer	Mk 15 Mod 1
Tracer	Mk 5
Fuzes	
Base	Mk 21 Mod 0 and 1 Mk 23 Mod 0

Base Fuze Mk 21 is preferred. Mk 23 to be used only when Mk 21 is not available.

8-inch A.P. Mk 21 Mods 1—5

Guns used in	8″/55
Over-all length, inches	
With cap and windshield	36.0
Without cap and windshield	24.5
Diameter of base, inches	7.977
Distance base to band, inches	2.56
Width of band, inches	3.30
Diameter at bourrelet, inches	7.977
Filling	Explosive D
Weight of filling, pounds	5.03
Weight of loaded projectile, pounds	335
Charge/weight ratio	1.5%
Primer	Mk 15 Mod 1
Tracer	Mk 5
Fuzes	
Base	Mk 21 Mods 0 and 1 Mk 23 Mod 0

Base Fuze Mk 21 is preferred. Mk 23 to be used only when Mk 21 is not available.

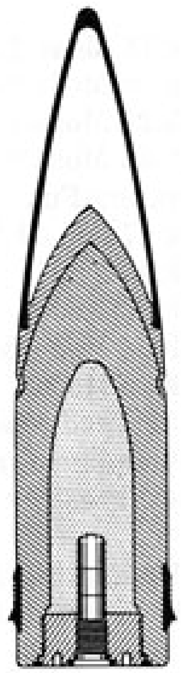


Figure 56. 8–inch Special Common Mk 17 Mods 1—4

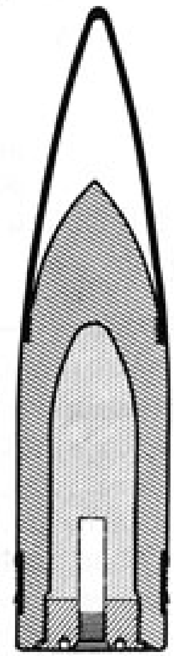


Figure 57. 8–inch Common Mk 14 Mod 1

8-inch Special Common Mk 17 Mods 1—4

Guns used in........................8"/55
Over-all length, inches................36.0
Diameter of base, inches.............7.977
Distance base to band, inches..........2.56
Width of band, inches................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds............10.38
Weight of loaded projectile, pounds.....260
Charge/weight ratio................3.99%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base................Mk 21 Mods 0 and 1
Mk 23 Mod 0

The Base Fuze Mk 21 is preferable for this projectile. Several have also been fuzed with the Base Fuze Mk 28 on account of a lack of sufficient H.C. projectiles.

8-inch Common Mk 14 Mod 1

Guns used in.......................8"/55
Over-all length, inches
With cap and windshield............36.0
Without cap and windshield.........26.19
Diameter of base, inches.............7.977
Distance base to band, inches..........2.56
Width of band, inches................3.30
Diameter at bourrelet, inches..........7.977
Filling ....Explosive D
Weight of filling, pounds.............10.91
Weight of loaded projectile, pounds.....260
Charge/weight ratio 4.4%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
Base................Mk 21 Mods 0 and 1
Mk 23 Mod 0

The Base Fuze Mk 23 is used only when the Mk 21 is not available.

8-inch Common Mk 15 Mod 1

Guns used in.......................8"/55
Over-all length, inches
With cap and windshield.............36.0
Without cap and windshield.........26.19
Diameter of base, inches.............7.977
Distance base to band, inches..........2.56
Width of band, inches................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds.............11.46
Weight of loaded projectile, pounds.....260
Charge/weight ratio 4.4%

Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes
  Base ....Mk 21 Mods 0 and 1
                       Mk 23 Mod 0

The Base Fuze Mk 23 is used only when the Mk 21 is not available.

8-inch H.C. Mk 24 Mods 1—5

Guns used in.......................8"/55
Over-all length, inches
  With nose fuze....................34.56
  Without nose fuze.................31.08
Diameter of base, inches..............7.977
Distance base to band, inches..........2.56
Width of band, inches.................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds............21.34
Weight of loaded projectile, pounds.....260
Charge/weight ratio 8.21%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5 Mod 1
Fuzes
  Base .....Mk 28 and all Mods
            Mk 39 Mods 0 and 1
            Mk 48 Mods 0 and 1
  Nose.....Mk 18 Mods 2, 3, and 4 (M.T.F.)
           Mk 50 Mods 0–3 (M.T.F.)
           Mk 29 Mods 1, 2, and 3 (P.D.F.)
           Mk 63 Mods 0 (M.T.F.)
  Auxiliary Detonating Fuze
           Mk 17 and all Mods
           Mk 46 Mod 0
           Mk 35 Mod 0
           Mk 54 Mod 0 and 1
           Mk 55 Mod 0

Base Fuze Mk 48 (and Mods) is the current and preferred assembly for this projectile; however, the Base Fuzes Mk 39 or Mk 28 may be used.

The Auxiliary Detonating Fuze Mk 55 is the preferred assembly in this projectile.

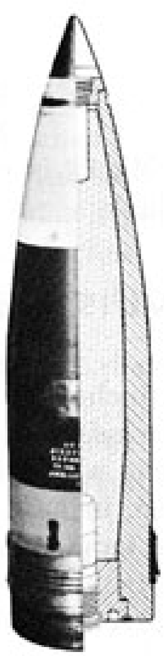


Figure 58. 8–inch H.C. Mk 24 Mods 1—5

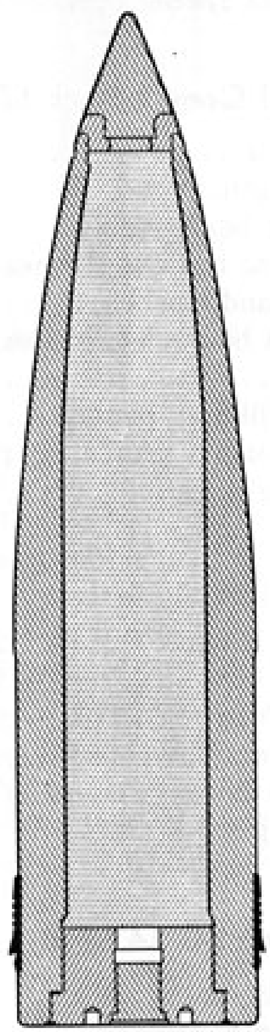


Figure 59. 8–inch H.C. Mk 25 Mod 1

8-inch H.C. Mk 25 Mod 1

Guns used in........................8"/55
Over-all length, inches
  With nose fuze...................34.605
  Without nose fuze.................31.13
Diameter of base, inches..............7.977
Distance base to band, inches...........2.0
Width of band, inches..................3.30
Diameter at bourrelet, inches.........7.977
Filling ....Explosive D
Weight of filling, pounds.............21.37
Weight of loaded projectile, pounds.....260
Charge/weight ratio 8%
Primer (bag gun)..............Mk 15 Mod 1
Cartridge Case ....Mk 1
Primer ....Mk 35
Tracer ....Mk 5
Fuzes
  Base................Mk 21 Mods 0 and 1
  Mk 23 Mod 0

The Base Fuze Mk 21 is preferred.

This projectile is designed so that it may be manufactured by forging from the base end.

Part I — Chapter I — Section 8

12-INCH PROJECTILES

12-inch A.P. Mk 15 Mod 6

Guns used in.......................12"/50
Over-all length, inches...............42.00
Diameter of base, inches..............11.94
Distance base to band, inches...........1.00
Width of band, inches..................4.00
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds...............25.0
Weight of loaded projectile, pounds.....870
Charge/weight ratio.................2.87%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

This is an old type projectile, without windshield, which is not in common use.

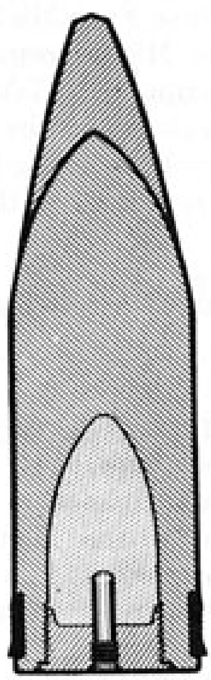


Figure 60. 12-inch A.P. Mk 15 Mod 6

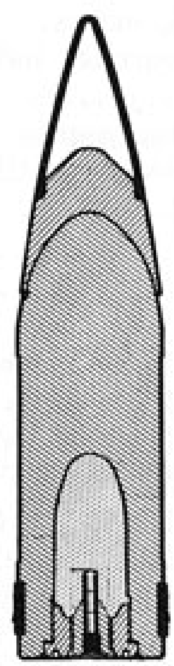


Figure 61. 12-inch A.P. Mk 18 Mod 1

12-inch A.P. Mk 18 Mod 1

Guns used in......................12"/50
Over-all length, inches
With cap and windshield...........54.00
Without cap and windshield.........38.39
Diameter of base, inches............11.977
Distance base to band, inches.........3.10
Width of band, inches.................4.0
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds..............17.4
Weight of loaded projectile, pounds....1,140
Charge/weight ratio................1.52%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5
Fuzes...........Base—Mk 21 Mod 0 and 1

The windshield is threaded to the A.P. cap and held in place by five equally spaced notches which are staked. The A.P. cap weighs 110.98 pounds and is soldered to the nose. In addition to the solder, the cap is also secured by seven crimp caps equally spaced on the periphery of the nose.

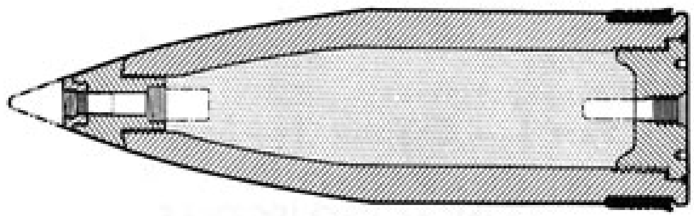


Figure 62. 12–inch H.C. Mk 16 Mods 1 and 2

12-inch H.C. Mk 16 Mods 1 and 2, and Mk 21

Guns used in......................12"/50
Over-all length, inches
With nose fuze 43.76
Without nose fuze................40.285
Diameter of base, inches............11.977
Distance base to band, inches...........1.0
Width of band, inches.................4.0
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds............58.20
Weight of loaded projectile, pounds.....740
Charge/weight ratio 7.86%
Primer ....Mk 15 Mod 1
Tracer ....Mk 5 Mod 1
Fuzes
Base......Mk 28 "green stripe"
Mk 39 Mods 0 and 1
Mk 48 Mods 0 and 1
Nose......Mk 29 Mods 1, 2, and 3 (P.D.F.)
Mk 42 Mod 0 (M.T.F)
Mk 62 Mod 0 (M.T.F.
Auxiliary Detonating Fuze
Mk 17 Mod 8 "green stripe"
Mk 35 Mod 0
Mk 55 Mod 0
Booster Mk 5, or a special 0.53-pound pressed TNT booster, is also used under the auxiliary detonating fuze

The 12-inch H.C. Projectile is merely a redesignation of the Mk 16.

The Base Fuze Mk 39 replaces the original "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Nose Fuze Mk 62 is the preferred nose time fuze.

12-inch H.C. Mk 17 Mods 1 and 2, and Mk 22

Guns used in......................12"/50
Over-all length, inches
With nose fuze.....................54.0
Without nose fuze.................50.18
Diameter of base, inches.............11.977
Distance base to band, inches...........3.1
Width of band, inches..................4.0
Diameter at bourrelet, inches........11.977
Filling ....Explosive D
Weight of filling, pounds.............79.44
Weight of loaded projectile, pounds......940

Charge/weight ratio 8.45%
Primer .... Mk 15 Mod 1
Tracer .... Mk 5 Mod 1
Fuzes
Base .... Mk 28 "green stripe"
Mk 39 Mods 0 and 1
Mk 48 Mods 0 and 1
Nose .... Mk 29 and Mods 1, 2, and 3 (P.D.F.)
Mk 42 Mod 0 (M.T.F.)
Mk 62 Mod 0 (M.T.F.)
Steel Nose Plug
Auxiliary Detonating Fuze
Mk 17 Mod 8 "green stripe"
Mk 35 Mod 0
Mk 55 Mod 0

Mk 5 Booster, or special 0.53 pound pressed TNT booster, is used under the auxiliary detonating fuze.

The 12-inch H.S. Projectile Mk 22 is merely a redesignation of the Mk 17.

The Base Fuze Mk 39 replaces the original special "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Mk 62 is the preferred nose time fuze.

The 12-inch H.C. Projectile Mk 17 Mod 2 differs from the Mk 17 Mod 1 in that its base plug threads are 7.85″ instead of 7.75″.

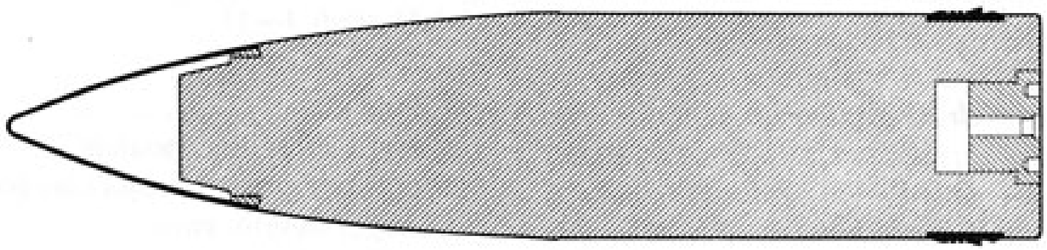


Figure 63. 12–inch Target Mk 19 Mod 1

12-inch Target Mk 19 Mod 1

Guns used in .... 12″/50 Mk 8
Over-all length, inches 54
Diameter of base, inches 11.977
Distance base to band, inches 2.0
Width of band, inches 4.0
Diameter at bourrelet, inches 11.977
Weight of loaded projectile, pounds 1,140
Primer .... Mk 15 Mod 1
Tracer (if loaded) .... Mk 5

There is no provision for a spotting dye load in the windshield of this projectile.

Part I — Chapter I — Section 9

14-INCH PROJECTILES

14-inch A.P. Mk 8 Mods 3, 7, 8, and 11 (Obsolete)

Guns used in .... 14″/45
14″/50
Over-all length, inches 49.44
Without cap & windshield 41.92
Diameter of base, inches 13.94
Distance base to band, inches 1.0
Width of band, inches 4.66
Diameter at bourrelet, inches 13.977
Filling .... Explosive D
Weight of filling, pounds 34.30
Weight of loaded projectiles, pounds ... 1,402
Charge/weight ratio 2.1%
Primer .... Mk 15 Mod 1
Tracer .... Mk 5
Fuzes .... Base—Mk 21 Mods 0 and 1

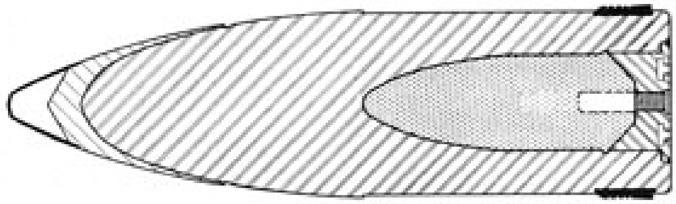


Figure 64. 14–inch A.P. Mk 8 Mods 3, 7, 8, and 11

A special adapter with 1.5-inch diameter outside threads is required to fit Base Fuzes Mk 21 in these projectiles.

The Mod 7 projectile may also be issued B.L. & P. or B.L. & T. with adapter and Tracer Mk 5 Mod 1 for target practice.

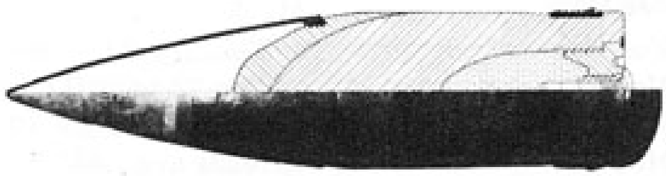


Figure 65. 14–inch A.P. Mk 16 Mods 1—11

14-inch A.P. Mk 16 Mods 1—11

Guns used in	14"/45 14"/50
Over-all length, inches	
With cap & windshield	56.00
Without cap & windshield	36.72
Diameter of base, inches	13.977
Distance base to band, inches	3.46
Width of band, inches	4.66
Diameter at bourrelet, inches	13.977
Filling	Explosive D
Weight of filling, pounds	22.90
Weight of loaded projectile, pounds	1,500
Charge/weight ratio	1.5%
Primer	Mk 15 Mod 1
Tracer	Mk 5
Fuzes	Base—Mk 21 Mods 0 and 1

The Mod 11 has a slight change in the cap design which moves the windshield threads further forward on the projectile.

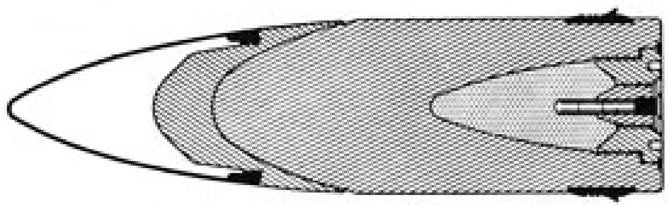


Figure 66. 14–inch A.P. Mk 20 Mod 1

14-inch A.P. Mk 20 Mod 1

Guns used in	14"/45
Over-all length, inches	54.38
Diameter of base, inches	13.977
Distance base to band, inches	3.46
Width of band, inches	4.66
Diameter at bourrelet, inches	13.977
Filling	Explosive D
Weight of filling, pounds	22.90
Weight of loaded projectile, pounds	1,500
Charge/weight ratio	1.5%
Primer	Mk 15 Mod 1
Tracer	Mk 5
Fuzes	Base—Mk 21 Mods 0 and 1

This projectile is used only on the battleships New York and Texas. It is the same as the Mk 16 Mod 8, except for a shortened windshield.

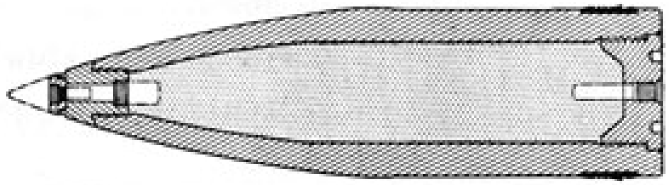


Figure 67. 14–inch H.C. Mk 19 Mods 1—6 and Mod 22

14-inch H.C. Mk 19 Mods 1—6 and Mk 22

Guns used in....................... 14"/45
14"/50

Over-all length, inches
- With nose fuze....................... 56.0
- Without nose fuze.................. 52.18

Diameter of base, inches............. 13.977
Distance base to band, inches.......... 3.46
Width of band, inches.................. 4.66
Diameter at bourrelet, inches......... 13.977
Filling .... Explosive D
Weight of filling, pounds............ 104.21
Weight of loaded projectile, pounds.... 1,275
Charge/weight ratio................ 8.01%
Primer..................... Mk 15 Mod 1
Tracer...................... Mk 5 Mod 1

Fuzes
- Base...... Mk 28 "green stripe"
  Mk 39 Mods 0 and 1
  Mk 48 Mods 0 and 1
- Nose...... Mk 29 Mods 1, 2, and 3 (P.D.F.)
  Mk 42 Mod 0 (M.T.F.)
  Mk 62 Mod 0 (M.T.F.)
  Steel Nose Plug
- Auxiliary Detonating Fuze
  Mk 17 Mod 8 "green stripe"
  Mk 35 Mod 0
  Mk 55 Mod 0
  Booster Mk 5, or a special 0.53-pound pressed TNT booster, will be used under the auxiliary detonating fuze.

The Base Fuze Mk 39 replaces the original special "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Mk 62 is the preferred nose time fuze.

Projectile Mk 19 Mod 1 only is suitable for use in 14"/45 guns on the battleships New York and Texas.

The 14-inch H.C. Projectile Mk 22 is similar in its dimensions to the Mk 19, except that the rotating band on the Mk 22 is only 2.25 inches from the base.

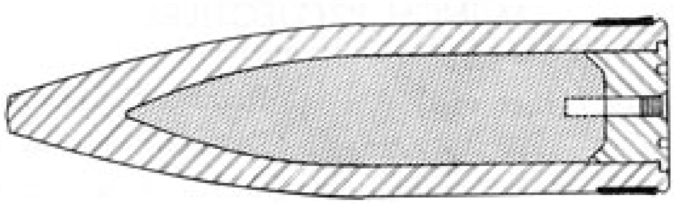


Figure 68. 14–inch Bombardment Mk 9

14-inch Bombardment Mk 9

Guns used in....................... 14"/45
14"/50

Over-all length, inches................ 56.0
Diameter of base, inches.............. 13.94
Distance base to band, inches........... 1.0
Width of band, inches................. 4.66
Diameter at bourrelet, inches........ 13.977
Filling .... Explosive D
Weight of filling, pounds............... 105
Weight of loaded projectile, pounds.... 1,410

Charge/weight ratio................7.44%
Cartridge Case...................Bag gun
Primer......................Mk 14 Mod 1
Tracer..................Mk 5, Mk 5 Mod 1

Fuzes............Base—Mk 28 and all Mods

The Base Fuze Mk 28 replaces the previously used Base Fuze Mk 3 Mod 2 with integral tracer.

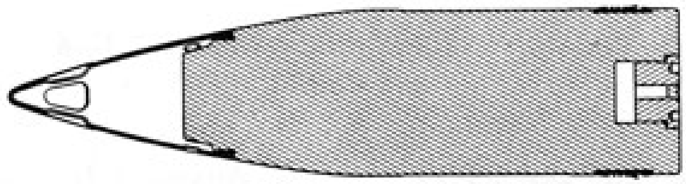


Figure 69. 14–inch Target Mks 17 and 18

14-inch Target Mk 17 Mods 1—3 and Mk 18 Mod 1

Guns used in......................14"/45
14"/50
Over-all length, inches.................56
Diameter of base, inches............13.977
Distance base to band, inches.........2.25
Width of band, inches................4.66
Diameter at bourrelet, inches........13.977
Weight of loaded projectile, pounds....1,500
Primer......................Mk 15 Mod 1
Tracer (if loaded)..................Mk 5

There is no spotting dye load in the Mk 17 windshield.

The 14-inch Target Projectile Mk 18 Mod 1 has essentially the same dimensions, plus a spotting dye load.

14-inch Target Mk 21 Mod 1

Guns used in......................14"/45
Over-all length, inches...............54.38
Diameter of base, inches.............13.977
Distance base to band, inches..........2.25
Width of band, inches................4.66
Diameter at bourrelet, inches.........13.977
Weight of loaded projectile, pounds....1,500
Primer......................Mk 15 Mod 1
Tracer.............................Mk 5

This target projectile was made to match the 14-inch A.P. Projectile Mk 20 for the U.S.S. Arkansas and Texas guns.

Part 1 — Chapter 1 — Section 10

16-INCH PROJECTILES

16-inch A.P. Mk 3 Mods 2—5 (Obsolete)

Guns used in......................16"/45
Over-all length, inches................56.5
Diameter of base, inches..............15.94
Distance base to band, inches..........3.03
Width of band, inches.................5.30

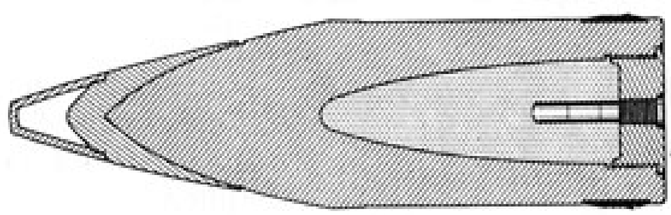


Figure 70. 16–inch A.P. Mk 3 Mods 2—5

Diameter at bourrelet, inches........15.977
Filling.......................Explosive D
Weight of filling, pounds..............57.5
Weight of loaded projectile, pounds....2,110
Charge/weight ratio................2.74%
Primer.....................Mk 15 Mod 1
Tracer............................Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

This projectile was originally issued without windshield, but has since been modified.

The 16-inch A.P. Projectile Mk 3 Mod 2 has been declared unserviceable until caps and windshields have been modified.

Mods 2 and 3 may be blind loaded and plugged or tracered with the Tracer Mk 5 Mod 1 for target practice.

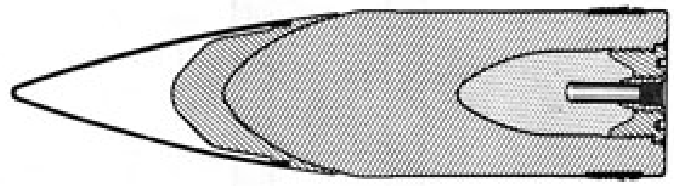


Figure 71. 16–inch A.P. Mk 5 Mods 1—5

16-inch A.P. Mk 5 Mods 1—6

Guns used in......................16″/45
Over-all length, inches
With cap & windshield..............64.0
Without cap & windshield.........43.387
Diameter of base, inches.............15.977
Distance base to band, inches...........4.03
Width of band, inches.................5.32
Diameter at bourrelet, inches........15.977
Filling.......................Explosive D
Weight of filling, pounds.............34.0
Weight of loaded projectile, pounds....2,240
Charge/weight ratio...............1.5%
Primer.....................Mk 15 Mod 1
Tracer............................Mk 5
Fuzes...........Base—Mk 21 Mods 0 and 1

The 16-inch A.P. Projectile Mk 5 Mod 6 is a modified Mk 12 (designed for Army use) with a special base-plug adapter.

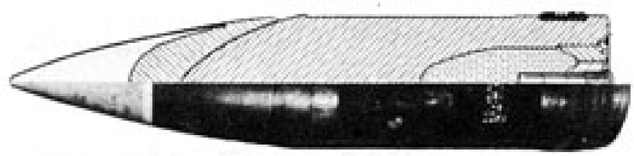


Figure 72. 16–inch A.P. Mk 8 Mods 1—8

16-inch A.P. Mk 8 Mods 1—8

Guns used in......................16″/45
16″/50
Over-all length, inches
With cap & windshield..............72.0
Without cap & windshield............51.6
Diameter of base, inches.............15.977
Distance base to band, inches..........4.03
Width of band, inches.................5.32
Diameter at bourrelet, inches........15.977
Filling.......................Explosive D
Weight of filling, pounds..............40.90
Weight of loaded projectile, pounds....2,700
Charge/weight ratio...............1.5%
Primer.......................Mk 15 Mod 1
Tracer............................Mk 5
Fuzes..........Base—Mk 21 Mods 0 and 1

The Mod 8 has a heavier cap, blunter nose, and more hardness, from greater heat treatment than the earlier Mods.

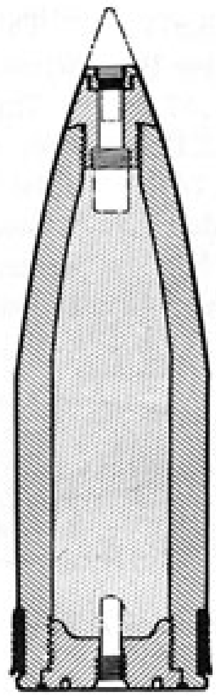


Figure 73. 16–inch H.C. Mk 13 Mods 0—6 and Mk 14

16-inch H.C. Mk 13 Mods 0—6 and Mk 14

Guns used in........................16"/45
16"/50

Over-all length, inches

With nose fuze......................64.0

Without nose fuze..................60.18

Diameter of base, inches............15.977

Distance base to band, inches..........4.03

Width of band, inches.................5.32

Diameter at bourrelet, inches........15.977

Filling ....Explosive D

Weight of filling, pounds.............153.6

Weight of loaded projectile, pounds....1,900

Charge/weight ratio 8.08%

Primer......................Mk 15 Mod 1

Tracer.......................Mk 5 Mod 1

Fuzes

Base ......Mk 28 "green stripe"
Mk 39 Mods 0 and 1
Mk 48 Mods 0 and 1

Nose......Mk 29 Mods 1, 2, and 3 (P.D.F.)
Mk 42 Mod 0 (M.T.F.)
Mk 62 Mod 0 (M.T.F.)
Steel Nose Plug

Auxiliary Detonating Fuze
Mk 17 Mod 8 "green stripe"
Mk 35 Mod 0
Mk 55 Mod 0
Booster Mk 5, or a special 0.53-pounds pressed TNT booster, will be used under the auxiliary detonating fuze.

This projectile is normally issued with an A.P. nose plug.

The 16-inch H.C. Projectile Mk 13 Mod 1 was originally issued as the 16" Ex–1.

The Base Fuze Mk 39 replaces the original special "green stripe" Base Fuze Mk 28; the Auxiliary Detonating Fuze Mk 35 replaces the original special "green stripe" Mk 17 Mod 8. These fuzes are now being replaced by the Base Fuze Mk 48 and the Auxiliary Detonating Fuze Mk 55.

The Mk 14 is simply a different designation to indicate a different manufacturer.

16-inch Target Mk 6 Mod 1 and Mk 7 Mod 0

Guns used in. . . . . .16"/45 Mks 6 and 8
Over-all length, inches. 64
Diameter of base, inches. 15.977
Distance base to band, inches. 2.5
Diameter at bourrelet, inches. 15.977
Weight of loaded projectile, pounds. . . .2,240
Primer. . . . . .Mk 15 Mod 1
Tracer . . . . .Mk 5

Mk 6 has no spotting dye; Mk 7 does. These target projectiles are designed to use the same ballistic as the 16-inch A.P. Projectile Mk 5.

16-inch Target Mk 9 Mods 1 and 2, and Mk 10 Mod 0

Guns used in. . . . . .16"/45 Mk 6 Mod 1
16"/50 Mk 7 Mod 0
Over-all length, inches. 72
Diameter of base, inches. 15.977
Distance base to band, inches. 2.5
Diameter at bourrelet, inches. 15.977
Weight of loaded projectile, pounds. . . .2,700
Primer. . . . . .Mk 15 Mod 1
Tracer. . . . . .Mk 5

Mods 1 and 2 of the 16-inch Target Projectile Mk 9 are physically the same. Different Mods distinguish products of different contractors. The Mk 9's have no spotting dye.

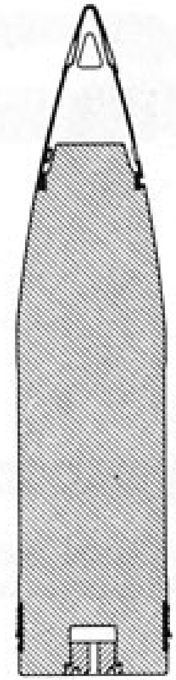


Figure 74. 16–inch Target Mk 9 and Mk 10

Mk 10 is exactly like the Mk 9, except that it contains a spotting load.

These target shells match the 16-inch A.P. Projectile Mk 8 in ballistic traits.

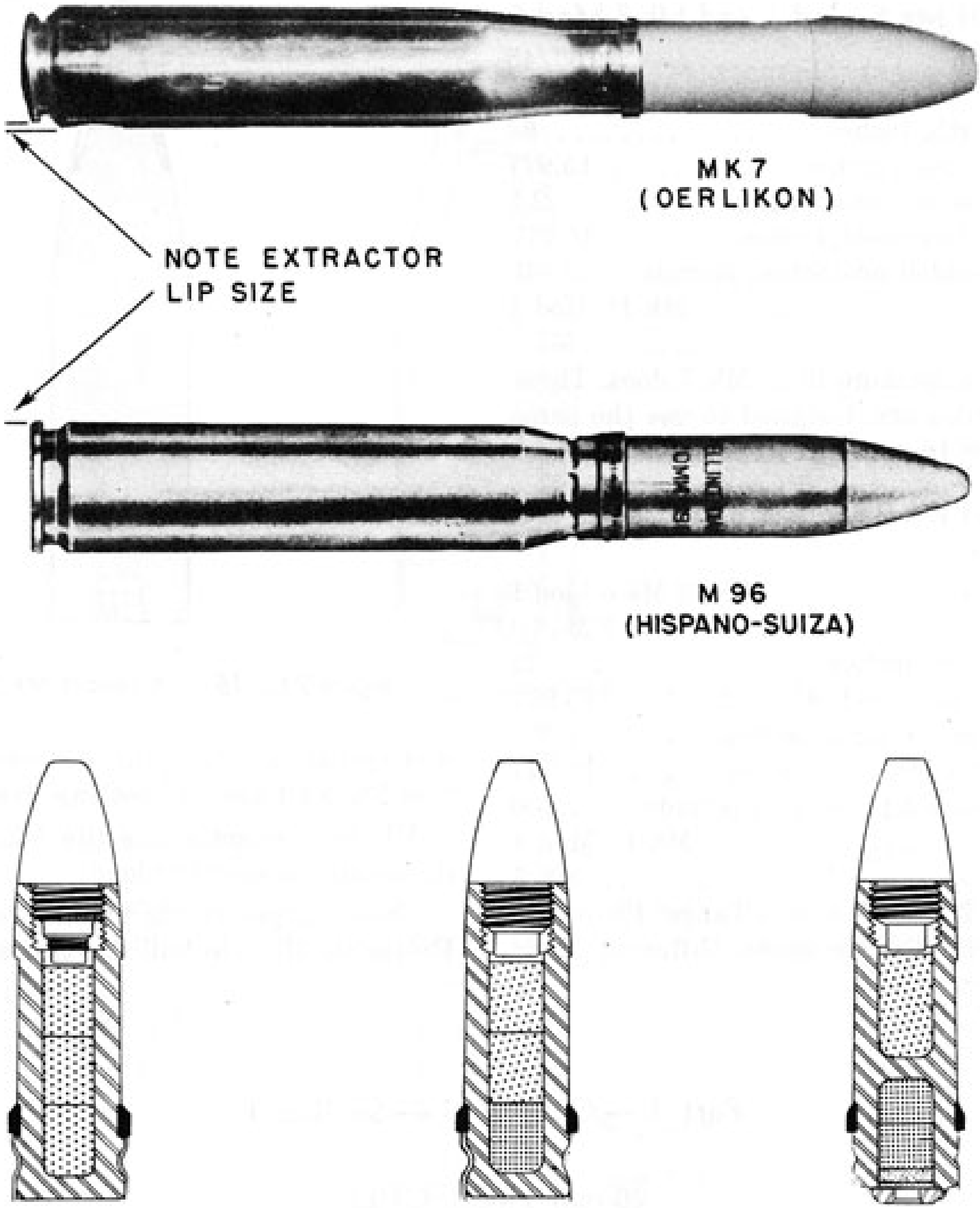
Part I — Chapter I — Section II

20-mm PROJECTILES

20-mm A.A. H.E., H.E.–I., and B.L. & P. Mk 3 Mods 1—64

Over-all length, inches
With nose fuze. 3.275
Without nose fuze. 2.625
Diameter of base, inch. 0.74
Distance base to band, inch. 0.374
Width of band, inch. 0.16
Diameter at bourrelet, inch. 0.78
Filling
H.E.: . . . . .0.0243 lb. tetryl or pentolite
H.E.–I.: . . . . . . .0.0072 lb. incendiary mix; 0.0171 lb. tetryl or pentolite
Weight of loaded projectile, pound. . . .0.2714
Charge/weight ratio. 8.9%
Cartridge Case. . . . . . . .H.E.: Mk 2
H.E.–I.: Mk 2, 3, or 4
Primer . . . . .H.E.: Mk 30
H.E.–I.: Mk 30 or 31
Fuzes. . . . . .Nose—Mk 26 Mods 0 and 1

The explosive filling of the H.E. projectile is press-loaded in three equal increments. The H.E.–I. projectile is similarly loaded, but the first increment consists of an incendiary mixture, the other two of H.E., either tetryl or pentolite.



MK 3 HE MK 3 HE-I MK 4&7 HE-T

Figure 75 (Part 1). 20–mm Projectiles

This round is also issued B.L. & P., with an inert filler and a dummy nose cap.

Identification—marking and painting

Type	Color
H.E. (Tetryl)	White
H.E. (Pentolite)	Yellow
H.E.–I. (Tetryl)	Red
H.E.–I. (Pentolite)	Light pink
B.L. & P.	Dark gray green

The many modification numbers are to distinguish between products from different contracts.

20-mm A.A. H.E.–T. and B.L. & T. Mk 4 Mods 1—28 and Mk 7

(May have Dark Ignition tracers.)

Over-all length, inches 3.025

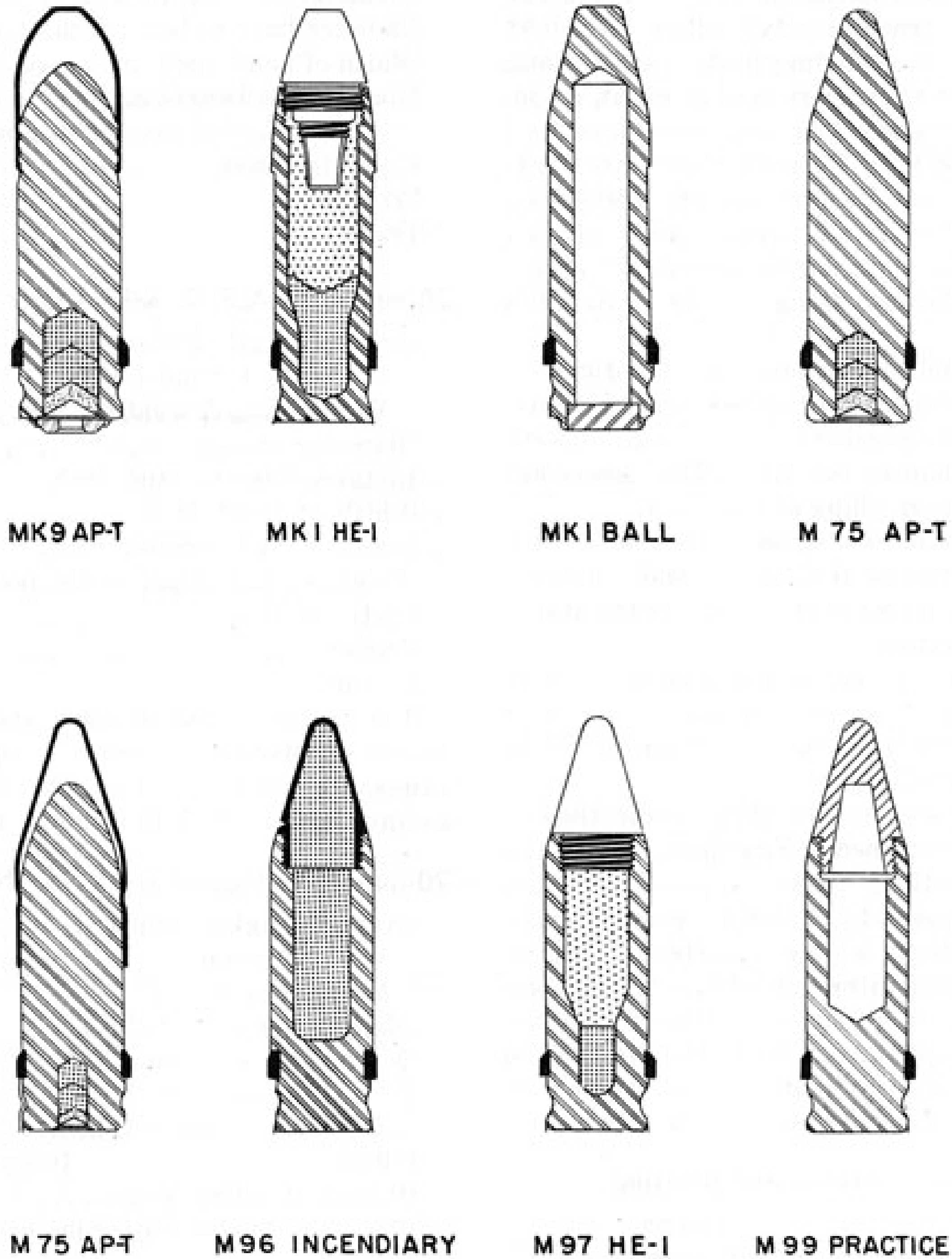


Figure 75 (Part 2). 20–mm Projectiles, continued

Without nose fuze....................2.525
Diameter of base, inch....................0.74
Distance base to band, inches..........0.397
Width of band, inch....................0.16
Diameter at bourrelet, inch............0.78
Filling....................Tetryl or Pentolite
Weight of filling, pounds
H.E.: 0.01 lb.
Tracer: 0.0173 lb.

Weight of loaded projectile, pound....0.2621
Cartridge Case ....Mk 2
Primer....................Mk 30
Tracer ....Integral
Fuzes
Nose....................Projectile Mk 4—
Mk 26 Mods 0 or 2
Projectile Mk 7—
Mk 26 Mods 0 or 1

Length of tracer cavity, inches........1.107
Diameter of tracer cavity, inches......0.51

To eliminate the blinding flash characteristic of standard 20-mm tracers fired at night, a special Dark Ignition tracer has been developed which does not light up until about 100 yards from the gun muzzle. Rounds are designated "H.E.–T.–D.I." Over-all burning time of this trace is four seconds; during the "dark" period there is a faint streaking in the projectile's path.

The Mk 4 and Mk 7 rounds are identical except for the dimensions of the tracer cavity, which is slightly greater in diameter and length in the Mk 4 than in the Mk 7. This somewhat reduces the tracer filling of the Mk 7.

The Mk 7 round is also issued B.L. & T. with an inert filler in the H.E. cavity and a dummy nose plug. The tracer cavity contains the standard tracer mixture.

The burster charge of the 20-mm is more sensitive than the usual projectile burster charge. Accordingly, greater caution should be observed in handling.

The tracer element in these projectiles is loaded in two increments. First increment is the tracer composition, which is pressed in the after compartment by hydraulic pressure; the second increment is the "starter" mixture, which is pressed in on top of the tracer composition and is more sensitive than the latter. When the projectile is fired, the heat from the propellent charge ignites the starter which, in turn, sets off the tracer composition.

Identification—marking and painting

Type	Color
*H.E.–T. (Tetryl) ..	Light gray
*H.E.–T. (Pentolite).	Blue
B.L. & T.	Dark gray green, with 1/8-inch yellow band

20-mm A.P.–T. Mk 9

Over-all length, inches
With cap & windshield.............3.051
Without cap & windshield..........2.449

*When assembled with Dark Ignition tracers, a 1/8-inch bright red band will be painted around the projectile midway between the bourrelet and the rotating band.

Diameter of base, inch................0.742
Distance base to band, inch...........0.315
Width of band, inch...................0.154
Diameter at bourrelet, inch...........0.784
Weight of loaded projectile, pound....0.2686
Cartridge Case...............Mks 3 and 4
Primer.........................Mk 31
Tracer ....Integral

20-mm A/C A.P.–T. M95 (New Series)

Over-all length, inches
With cap & windshield..............3.27
Without cap & windshield............2.40
Diameter of base, inch................0.76
Distance base to band, inch............0.39
Width of band, inch..................0.203
Diameter at bourrelet, inch............0.78
Weight of loaded projectile, pound......0.29
Cartridge Case M21A1
Primer M36A1
Tracer ....Integral

The tracer is red in color and burns for a period of about 2.25 seconds, equivalent to a range of about 1,400 yards. This round is superseding the A.P.–T. M75 round of the Old Series.

20-mm A/C Incendiary M96 (New Series)

Over-all length, inches
With nose cap....................3.245
Without nose cap..................2.30
Diameter of base, inch................0.76
Distance base to band, inch............0.39
Width of band, inch..................0.203
Diameter at bourrelet, inch............0.78
Filling................Incendiary Mixture
Weight of filling, pound..............0.020
Weight of loaded projectile, pound......0.27
Cartridge Case....................M21A1
Primer M36A1

The incendiary mixture fills both the nose cap and the projectile body. No fuze is required, since the functioning is initiated by impact of the nose with the target.

20-mm A/C H.E.–I. M97 (New Series)

Over-all length, inches
With nose fuze....................3.28
Without nose fuze..................2.44
Diameter of base, inch................0.76

Distance base to band, inch............0.39
Width of band, inch..................0.203
Diameter at bourrelet, inch............0.78
Filling...........Tetryl and Incendiary Mix
Weight of filling, pound..............0.017
Weight of loaded projectile, pound......0.29
Cartridge Case....................M21A1
Primer.........................M36A1
Fuzes........................Nose—M75

This round is superseding the H.E.–I. Mk 1 round of the Old Series.

20-mm A/C Practice M99 (New Series)

Over-all length, inches
With nose cap......................3.27
Without nose cap..................2.30
Diameter of base, inch................0.76
Distance base to band, inch............0.39
Width of band, inch..................0.203
Diameter at bourrelet, inch............0.78
Filling............................None
Weight of loaded projectile, pound......0.29
Cartridge Case....................M21A1
Primer.........................M36A1

This round is superseding the Ball Mk 1 round of the Old Series.

20-mm A/C H.E.–I. Mk I (Old Series)

Over-all length, inches................3.22
Diameter of base, inch...............0.770
Distance base to band, inch............0.50
Width of band, inch..................0.203
Diameter at bourrelet, inch...........0.784
Filling...........Tetryl and Incendiary Mix
Weight of filling, pound..............0.025
Weight of loaded projectile, pound.....0.290
Cartridge Case....................M21A1
Primer...........................M36
Fuzes......................No. 253 Mk 1

This round is to be superseded by the H.E.–I. M97 round of the new ballistically matched series. The H.E.–I. Mk 1 round is to be classified unserviceable by Naval activities as soon as replacement allowances or stocks of the M97 round are received.

20-mm A/C Ball Mk I (Old Series)

Over-all length, inches................3.31
Diameter of base, inch...............0.770
Distance base to band, inch............0.50
Width of band, inch..................0.203
Diameter at bourrelet, inch...........0.784
Filling............................None
Weight of loaded projectile, pound......0.28
Cartridge Case....................M21A1
Primer...........................M36

This round is to be superseded by the practice round M99 of the new ballistically matched series. The Ball Mk 1 round is to be classified unserviceable by Naval activities as soon as replacement allowances or stocks of the M97 round are received.

20-mm A/C A.P.–T. M75 (Old Series)

Over-all length, inches................3.25
Diameter of base, inch...............0.770
Distance base to band, inch............0.5
Width of band, inch..................0.203
Diameter at bourrelet, inch...........0.784
Filling............................None
Weight of loaded projectile, pound.....0.370
Cartridge Case....................M21A1
Primer...........................M36
Tracer.......................Integral

The tracer is red in color and burns for about four seconds, equivalent to a range of about 3,000 yards.

This round is to be superseded by the A.P.–T. M95 round of the new ballistically matched series. The A.P.–T. M75 round is to be classified unserviceable by Naval activities as soon as replacement allowances or stocks of the M95 round are received.

40-mm PROJECTILES

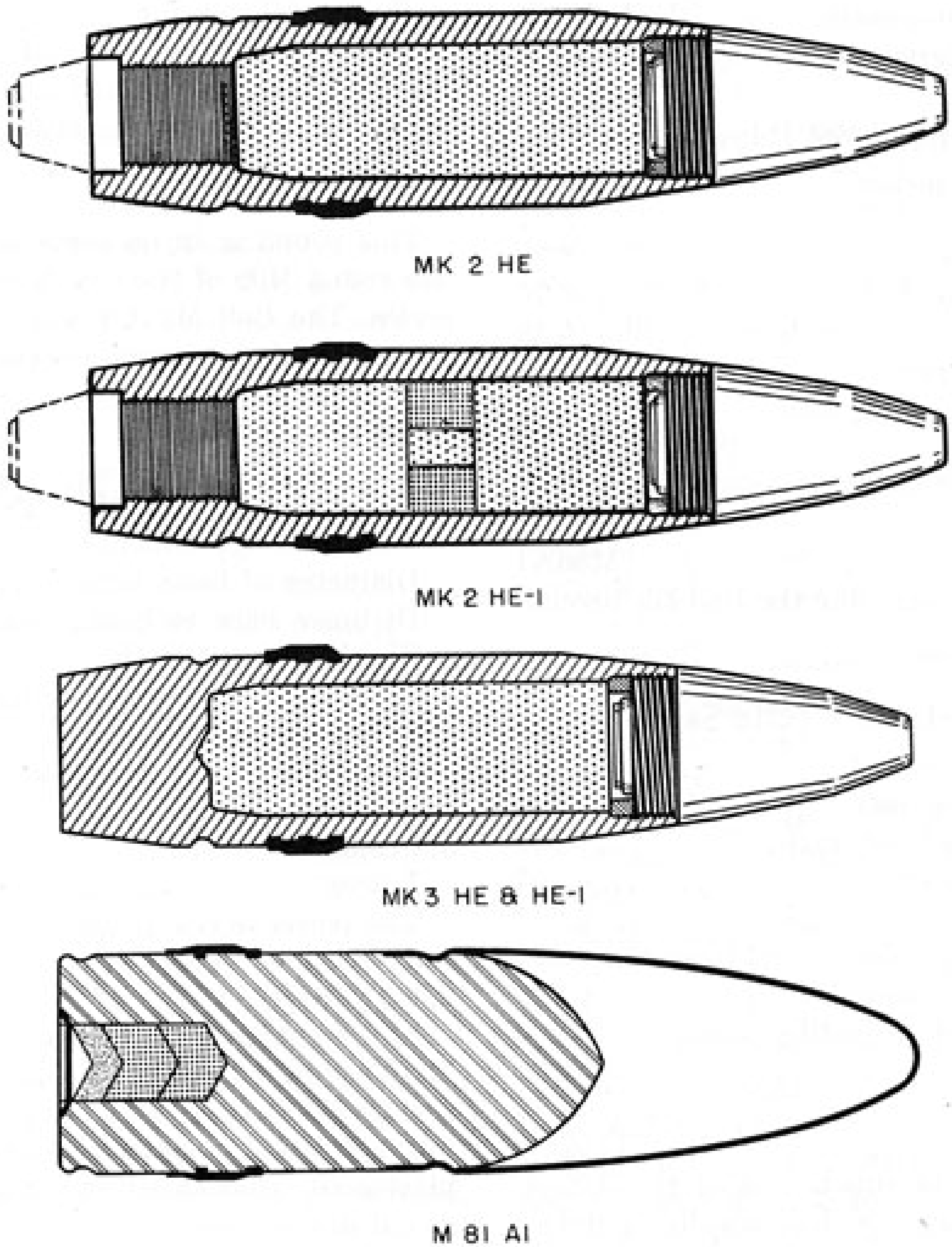


Figure 76. 40–mm Projectiles

40-mm A.A. H.E.–I. (a) Mk 1 Mods 1—24 and (b) Mk 2 Mods 1—35

(May have "Dark" or "Dark Ignition" tracer.)

Over-all length, inches
- With nose fuze 7.1
- Without nose fuze 5.2

Diameter of base, inches 1.3
Distance base to band, inches ...... (a) 1.675
(b) 1.730
Width of band, inch 0.6
Diameter at bourrelet, inches 1.57
Filling ... H.E.: Cast TNT
H.E.–I.: Cast TNT and Incendiary
Weight of filling, pound .... (a) 0.148
(b) 0.150
Weight of loaded projectile, pounds 1.985
Charge/weight ratio 5.0%
Cartridge Case .... Mk 1, Mk 2, Mk 3
Primer .... Mk 21 Mods 2 and 3; Mk 22 Mods 0 and 1
Tracer .... Mk 10, Mk 11
Fuzes .... Nose—Mk 27 Mods 0 and 1

See Tracer Mk 11 for "Dark" and "Dark Ignition" developments.

The Mk 1 and the Mk 2 projectiles are both loaded H.E. in three increments. The Mk 2 may also be loaded H.E.–I. with the central increment an incendiary composition. The Mk 2 H.E.–I. round may be issued plugged instead of tracered. Both projectile bodies may be issued B.L. & P. or B.L. & T. for target practice or de-icing.

Tracer Mk 10 has been declared unserviceable and is being replaced by the Tracer Mk 11 in all assemblies.

The 24 Mods of Mk 1 and the 35 Mods of Mk 2 are merely bookkeeping designations.

Identification—Marking and Painting

Type	Body	Color Band	Tip	Remarks
H.E.–P.	Green	Green	Green	Plug in tracer
H.E.–T./S.D.	Green	White	Green	
H.E./S.D.	Green	Black	Green	Non-luminous tracer
H.E.–I.–T./S.D.	Green	White	Red	
H.E.–I.–P.	Green	Red	Red	Plug in base
H.E.–I./S.D.	Green	Black	Red	Non-luminous tracer
H.E.–I.–T.	Green with black band	White	Red	S.D. relay not loaded
B.L. & T.	Red	White	Red	Dummy fuze
B.L. & P.	Red	Red	Red	Dummy fuze and plug in base

40-mm Mk 3

Except for some minor differences in dimensions, the main difference between the Mk 3 projectile and the Mks 1 and 2 is that there is no hole in the base of the Mk 3 for a tracer or plug. This design was developed when the tactical need for non-trace ammunition arose; but with the appearance of "Dark" tracers, the Mk 3 projectile's original purpose was eliminated.

40-mm A.A. M81A1 A.P. and A.P.–T.

Over-all length, inches 6.19
Diameter of base, inches 1.55
Distance base to band, inch 0.803
Width of band, inch 0.64
Diameter at bourrelet, inches 1.55
Weight of loaded projectile, pounds 1.96
Cartridge Case .... Mk 1, Mk 2, Mk 3
Primer .... Mk 21, Mk 22
Tracer .... Integral
Fuzes .... None

This projectile is an Army design manufactured for the Navy to Naval specifications.

The A.P. round has a plug in the tracer cavity; the A.P.–T. has a red tracer.

1.1-INCH PROJECTILES

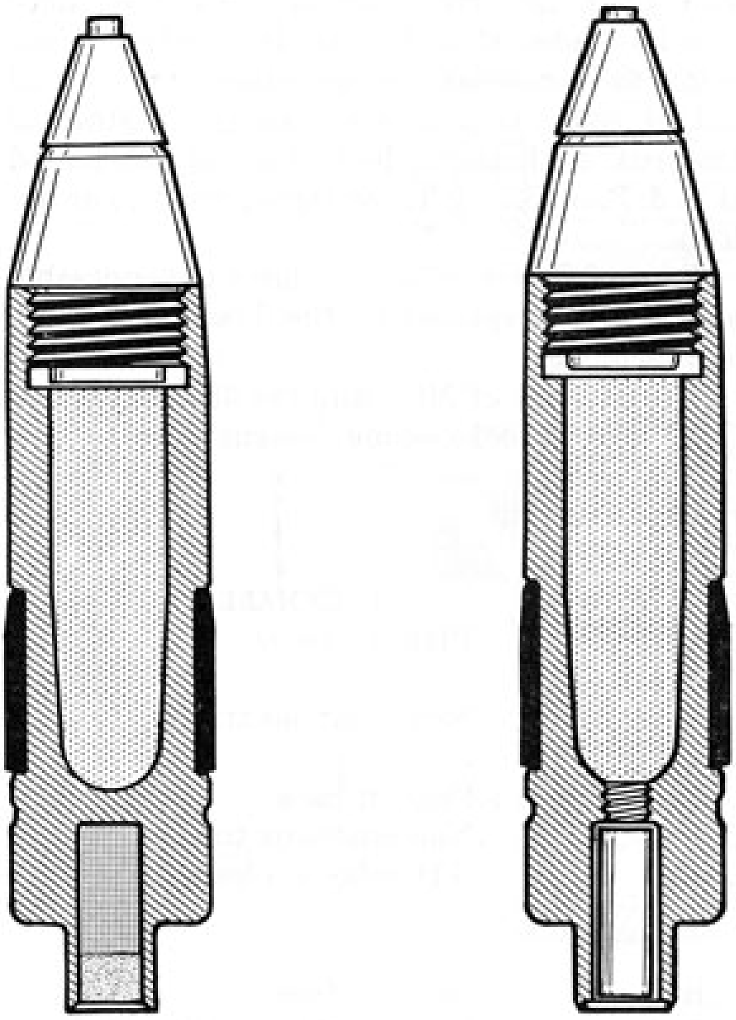


Figure 77. 1.1–inch Projectiles Mk 1 (right) and Mk 2 (left)

1.1-inch A.A. (a) Mk 1 Mods 0—28, (b) Mk S.D.1

Over-all length, inches
- With nose fuze 5.8
- Without nose fuze 4.1

Diameter of base, inches 1.085
Distance base to band, inch 0.87
Width of band, inch 1.0
Diameter at bourrelet, inches 1.095
Filling . . . . . Explosive D
Weight of filling, pound . . . . . (a) 0.037
(b) 0.034
Weight of loaded projectile, pound 0.917
Charge/weight ratio 4.0%
Cartridge Case . . . . . Mk 1
Primer . . . . . Mk 19 and Mods 1, 2, and 3
Tracer . . . . . Divided into two increments and pressed into the recess by hydraulic pressure, the tracer is ignited by the propellant charge from the cartridge case.

Fuzes
- Nose . . . . . Modified Mk 12 Mods 2 and 3 (P.D.F.)
  Mk 34 and all Mods (P.D.F.)

The 1.1-inch A.A. gun is not being further developed in the Navy.

The 1.1-inch Mk 1 is not self-destroying; the 1.1-inch Mk S.D. 1 is self-destroying. This is the primary difference between the two projectiles.

The Mk S.D. 1 consists of a Mk 1 projectile body modified for self-destruction by drilling through the wall between the tracer and H.E. cavities.

The Mk 1 projectile may also be issued B.L. & T. for target practice or de-icing.

The 28 Mods are to distinguish among contractors.

1.1-inch A.A. Mk 2 Mods 0 and 1

Over-all length, inches
- With nose fuze 5.7
- Without nose fuze 4.1

Diameter of base, inches 1.085
Distance base to band, inch 0.87
Width of band, inch 1.0
Diameter at bourrelet, inches 1.095
Filling . . . . . Explosive D
Weight of filling, pound 0.034
Weight of loaded projectile, pound 0.917
Charge/weight ratio 3.7%
Cartridge Case . . . . . Mk 1
Primer . . . . . Mk 19 and Mods 1, 2, and 3

Tracer.....Divided into two increments and pressed into the recess by hydraulic pressure, the tracer is ignited by the propellant charge from the cartridge case.

Fuzes
Nose........Modified Mk 12 Mods 2 and 3 (P.D.F.)
Mk 34 and all Mods (P.D.F.)

The Mk 2 has a self-destroying tracer.

Part I — Chapter I — Section 14

"POUNDER" PROJECTILES

1-Pounder Common Mk 2 Mods 0 and 1

Guns used in....................1-pdr./40
Over-all length, inches................3.56
Diameter of base, inches..............1.441
Distance base to band, inch...........0.829
Width of band, inch..................0.731
Diameter at bourrelet, inches.........1.445
Filling ....Black powder
Weight of filling, pound..............0.026
Weight of loaded projectile, pounds....1.088
Charge/weight ratio 2.07%
Cartridge Case ....Mk 2
Primer ....Mk 10 Mod 9
Tracer ....Integral
Fuzes..........Base—Mk 8 Mod 4 (B.I.F.)

This ammunition is used in coast guard guns. Their bursting charge is black powder and TNT, or black powder alone. This should be kept in mind when unscrewing the fuze, as some of the powder may have fallen down into the threads and the friction would cause detonation.

The Primer Mk 10 Mod 8 may be used for saluting charges only.

Base Fuzes Mk 2 Mod 9 and Mk 8 Mod 5, without tracers, may be used, but the Mk 8 Mod 4 is the preferred assembly.

This round may be issued B.L. & P. for target practice.

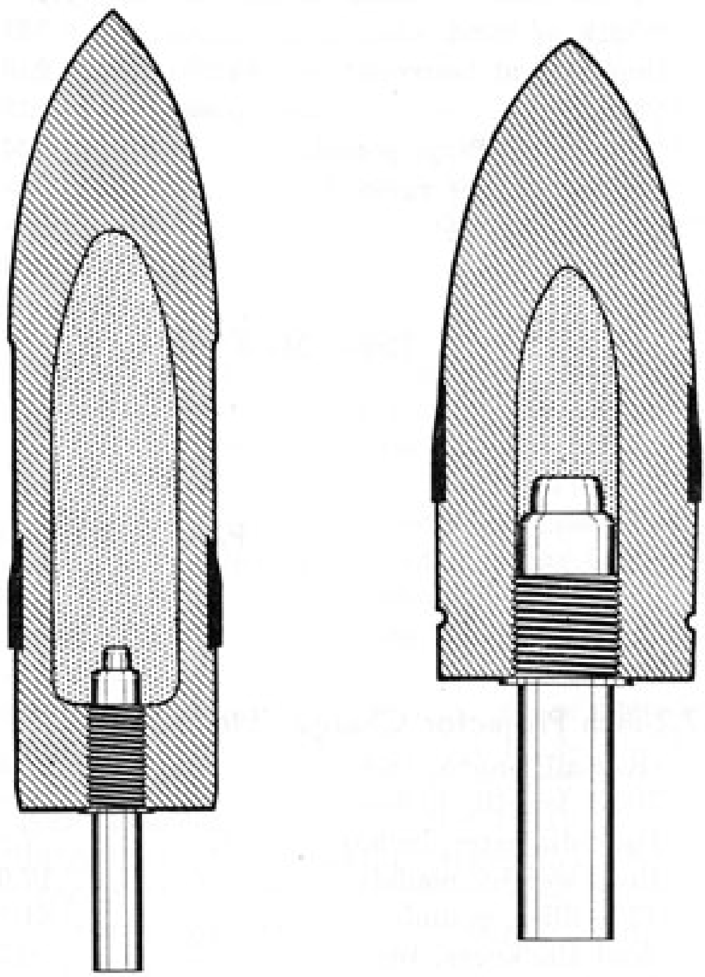


Figure 78. 3–Pounder Common Mk 4 and 1–Pounder Common Mk 2

3-Pounder Common Mk 4 Mod 1 (Obsolete)

Guns used in....................3-pdr./50
Over-all length, inches................6.681
Diameter of base, inches..............1.75
Distance base to band, inches.........1.185
Width of band, inch..................0.787
Diameter at bourrelet, inches.........1.845
Filling............Black powder and TNT
Weight of filling, pound................0.13
Weight of loaded projectile, pounds.....3.30
Charge/weight ratio 3.93%
Cartridge Case ....Mk 1
Primer ....Mk 10 Mod 9
Tracer ....Integral

Fuzes ....Base—Mk 8 Mod 4 (B.I.F.)

Fuzes Mk 8 Mod 5 and Mk 2 Mod 9, without tracers, may be used; but the Fuze Mk 8 Mod 4 is the preferred assembly. See other notes on 1-pounder Common.

6-Pounder Common Mk 3 Mods 3 and 4

Guns used in................6-pdr./40, /42
6-pdr./45, /50
Over-all length, inches................8.45
Diameter of base, inches.............2.224
Distance base to band, inches..........1.493
Width of band, inch.................0.787
Diameter at bourrelet, inches.........2.239
Filling.............Black powder and TNT
Weight of filling, pound...............0.24
Charge/weight ratio 4.00%
Cartridge Case ....Mk 1
Primer.....................Mk 10 Mod 9
Tracer ....Integral
Fuzes..........Base—Mk 8 Mod 4 (B.I.F.)

This round may be issued B.L. & P. or B.L. & T. with the Tracer Mk 7 for target practice. See other notes on 1-pounder Common.

6-Pounder Common Mk 5 Mods 0 and 3

Guns used in.................6-pdr./40,/42
6-pdr./45,/50
Over-all length, inches................8.26
Diameter of base, inches...............2.22
Distance base to band, inches..........1.493
Width of band, inch..................0.787
Diameter at bourrelet, inches..........2.237
Filling.............Black powder and TNT
Weight of filling, pound...............0.23
Weight of loaded projectile, pounds......6.0
Charge/weight ratio.................4.0%
Cartridge Case ....Mk 1
Primer.......................Mk 10 Mod 9
Tracer ....Integral in fuze
Fuzes..........Base—Mk 8 Mod 4 (B.I.F.)

See notes for 6-pounder Common Projectile Mk 3.

Part I — Chapter I — Section 15

7.2-INCH PROJECTILE

7.2-inch Projector Charge "Hedgehog"

Over-all length, inches................38.6
Head length, inches..................19.0
Head diameter, inches..................7.2
Head weight, pounds..................17.9
TNT filler, pounds....................31.1
Wall thickness, inch....................0.2
Tail tube diameter, inches.............1.75
Tail width, inches......................7.0

General: The projectile consists of a flat-nosed head with a conical tail fairing and parallel sides. The adapter and fuze thread into the nose. The motor unit consists of a smokeless powder cartridge with primer, which is lodged forward in the tail tube, the tube fitting over a firing post. The primer is detonated by electric contacts in the post. This charge is for use on Projectors Mk 10 and Mk 11.

The tail is a steel tube attached to the head by a threaded joint. Tail fins have a 10-degree twist and are attached with a drum support to give a slow rotation and stabilized trajectory.

Remarks: When Torpex is used, the weight is increased by approximately 2.5 pounds.

The above data are based on the 7.2-inch Head Mk 4A and the 1.75-inch P.C. Tail Mk 4A. These are being replaced by the 7.2-inch Head Mk 4 Mod 0 and the 1.75-inch P.C. Tail Mk 6 Mod 0.

Nose Fuzes Mk 136 and Mk 140 are replaced by the Nose Fuze Mk 158.

CARTRIDGE CASES AND BAG CHARGES

Cartridge cases

Propellant charges for small- and medium-caliber guns are assembled with primer and powder enclosed in a brass or steel container, or cartridge case. This assembly of the entire charge in a single, rigid, protecting case increases the ease and rapidity of loading and reduces the danger to personnel from flare-backs. On the other hand, additional care in handling must be exercised with this type of ammunition, since the cartridge case contains the powder charge and the primer.

Fixed ammunition: Guns of smaller caliber use "fixed ammunition," with the cartridge case firmly crimped to the base of the projectile. The following guns employ fixed ammunition: 20-mm, 40-mm, 1.1-inch, 1-pdr., 3-pdr., 6-pdr., 3"/23, 3"/50, 4"/50, and 5"/25.

Semi-fixed ammunition: Guns of larger caliber, for ease of handling, require separate loading of powder and projectile, or "semi-fixed ammunition." With this type of ammunition, the powder and primer are contained in a cartridge case, but the case is not crimped to the projectile. In semi-fixed ammunition, the powder is held firmly in place by a cardboard spacer and/or a cork closing plug. The following guns employ semi-fixed ammunition: 5"/38, 5"/51, 6"/47, and 8"/55.

Gas seal: Besides affording a safe and convenient method of loading, the cartridge case also prevents the escape of gases through the breech of the gun. The cartridge case has a fairly snug fit in the gun chamber and forms an effective gas seal by its expansion when the gun is fired.

High-Capacity, Reduced, and Target charges: To provide more flexibility in fire control when a variety of projectiles is used, a special charge is assembled for use with the light high-capacity projectiles and is known as a "high-capacity" charge. These charges contain less powder than their corresponding full charge. Also containing less powder, but designed mainly for reducing wear on gun chambers in target practice are the "reduced" and "target" charges. Weights and sizes of these particular charges are found in the table of "Existing Service Rounds" accompanying this chapter.

Short cases: When a round fails to be seated fully on ramming into the gun chamber, thus preventing closure of the breech, the projectile can still be fired by extracting the full-sized case and loading a "short" case. These are merely shorter models of regular cases. Their sizes and weights are included in the table of "Cartridge Case Specifications."

Special cases: Aside from the service-loaded, reduced-charge, and "short" cases, certain special types are also in use. These include saluting charges for 3"/23 and 1-, 3-, and 6-pounder guns; impulse charges for torpedoes, depth charges, and projector charges; and charges for line-throwing apparatus. These cases will not be described in this publication, since they are not primarily concerned with projectiles.

Bag charges

Principally because of the difficulty in handling very large cartridge cases, and especially in disposing of empties, the cartridge case in large-caliber guns is replaced by a powder charge assembled in a silk bag. The gas checking is accomplished by the mushroom and pads on the breech plug, and the primer is fired by a lock attached to the breech plug.

Bags used for bag charges are manufactured of pure silk without the admixture of any material other than sizing for the yarn. Heavy cloth is used for the body of the bags; light cloth, for the ignition ends. The ignition end of each bag consists of a red-colored quilted pocket containing an ignition charge of black powder.

Loading: Bag charges are either "dump" or "stack" loaded. In dump loading, the powder, after weighing, is dumped loosely into the bag, and the bag is then rolled and tightly laced to form a compact unit. For larger-caliber guns, stacked bags have almost completely replaced dump-loaded bags. Stacking places the powder grains on end in layers, so that a tight, compact, and uniform charge is obtained. Stacking results in greater ease for loading crews, a smaller charge bundle, a consistently uniform charge, and a longer life for the bag, as there is less chance for the sharp edges of the powder grains to cut the cloth of the bag. The arrangement of rows and number of grains in stacked charges is so fixed that the finished section will be the proper length according to Bureau of Ordnance standards. This arrangement differs with each bag index and is found by actually loading a test charge.

Nomenclature: As the term "Service Charge" has resulted in confusion, the new standard nomenclature is as follows:

FULL CHARGE—for use with H.C. or A.P. projectiles at full velocity.

REDUCED CHARGE—for use with A.P., target, or H.C. projectiles at reduced velocities.

SPECIAL — any charge other than those listed above.

The following types of bag charges may still be found:

SERVICE—for use with A.P. or H.C. projectiles at full velocity.

TARGET—for use with target projectiles.

HIGH-CAPACITY—for use with H.C. projectiles.

Special—any charge other than those listed above.

Charges suitable for use with either H.C. or target projectiles have hitherto been known as "H.C. Special" charges.

Types of powder

In both bag and case charges, the following types of powder are used:

SPD: This is smokeless powder stabilized by the addition of diphenylamine.

SPDN: This is stabilized smokeless powder with the further addition of certain nonvolatile materials to reduce hydroscopicity and increase service life.

SPCG: This is flashless double-base smokeless powder containing nitroglycerine and stabilized with carbamite. A new propellant, this one makes only one-half as much smoke as the older flashless powders. Made in the same physical shape as conventional powder, SPCG is chalk white in color and opaque, becoming slightly yellow with age. It contains only one-tenth the volatile solvent contained in pyro powder and is thus less susceptible to ballistic change from stowage. SPCG powder is governed by the same stowage regulations as SPD, SPDN, etc., except for the surveillance tests.

SPDF: Flashless smokeless powder.

SPDX: Water-dried stabilized smokeless powder.

SPDW: Reworked powder, for target use.

Marking of case and bag charges

Case markings: In addition to the information stamped on the head as shown in figure 79 the following marks are painted on the case:

Flashless powder: In cases loaded with flashless powder, a ¾-inch "F" should be painted in yellow somewhere on the head end. Also, the word "FLASHLESS" is painted on the side of the case.

Fixed and semi-fixed ammunition: Both fixed and semi-fixed ammunition cases have the index number painted in ¾-inch high letters on the head end of the case. In addition, semi-fixed charges also have their ammunition lot numbers painted on in a similar fashion.

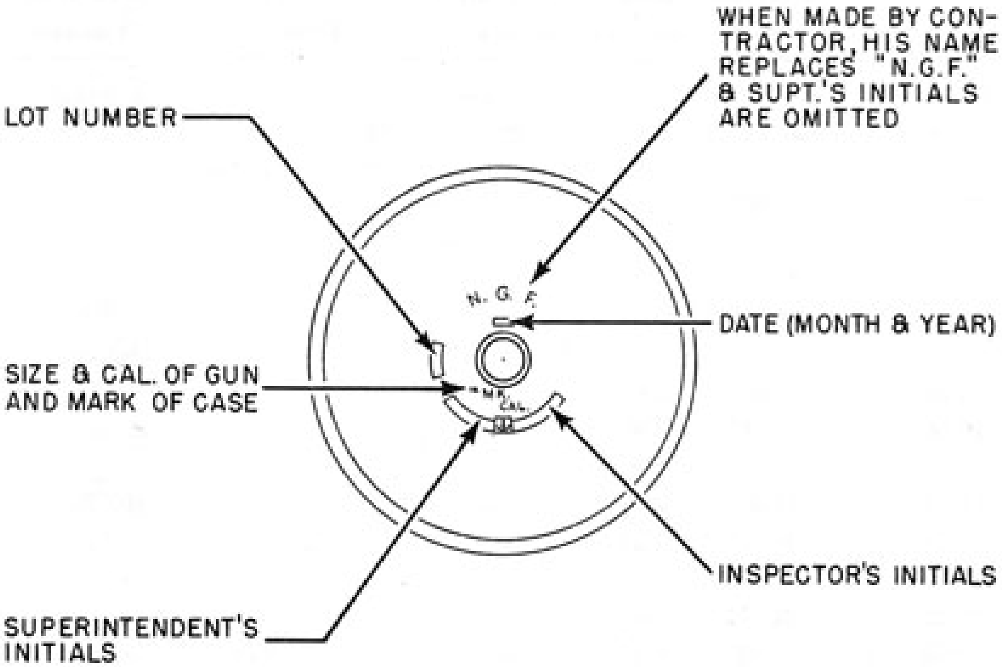


Figure 79. Stamping on Base of Cartridge Cases

Bag charges: These markings are lettered in ⅜-inch black characters on the side opposite to the lacings, with the bottom of the letters toward the ignition end of the bag:

Ammunition lot number

Caliber and length of gun in calibers—type of charge (full, reduced, etc.)

Index number of powder

Weight of powder charge

Number of sections per charge

Initial velocity and weight of projectile with which charge can be used.*

The word "FLASHLESS" in ¾″ high yellow letters if the charge is either flashless-type powder or powder with flashless pellets added.

*If two different initial velocities can be anticipated with different projectiles, the nominal velocity for each different projectile should be indicated, together with each projectile's weight.

CARTRIDGE CASE SPECIFICATIONS

Type	Gun	Over-all Length	Base Diameter	Material of Construction	Weight Empty	Weight of Propellant	Primer
3" Mk 2	3"/23	9.20"	3.46"	Brass	2.25 lb.	580 gram	Mk 10 Mod 9
3" Mk 3	3"/50	23.44"	4.30"	Brass	Mods 0 & 3: 7.0 lb.		
Mods 0, 2, & 3					Mod 2: 7.88 lb.	4.0 lb.	Mk 14, Mk 14 Mod 1
3" Mk 7 & 9	3"/50	22.99"	4.30"	Mk 7: Brass	Mk 7: 7.0 lb.		
				Mk 9: Steel	Mk 9: 6.54 lb.	4.0 lb.	Mk 14, Mk 14 Mod 1
4" Mk 2 Mod 0	4"/50	34.840"	5.90"	Brass	17.25 lb.	14.5 lb.	Mk 13 & all Mods
4" Mk 2 Mod 1	4"/50	33.74"	5.90"	Brass	17.0 lb.	14.5 lb.	Mk 13 & all Mods
4" Mk 2 Mod 3	4"/50	34.84"	5.90"	Brass	15.1 lb.	14.5 lb.	Mk 13 & all Mods
4" Mk 2 Mod 4	4"/50	33.74"	5.90"	Brass	14.9 lb.	14.5 lb.	Mk 13 & all Mods
5" Mk 3	5"/51	33.05"	7.40"	Brass	27.38 lb.	24.5 lb.	Mk 13 & all Mods
5" Mk 5	5"/38	26.75"	6.22"	Brass	12.31 lb.	15.2 lb.	Mk 13 & all Mods
5" Mk 4 Mod 0	5"/25	24.65"	5.90"	Brass	14.44 lb.	9.6 lb.	Mk 13 & all Mods
5" Mk 4 Mod 2	5"/25	24.65"	5.90"	Brass	11.4 lb.	9.6 lb.	Mk 13 & all Mods
5" Mk 6	5"/54	32.93"	6.22"	Brass	13.04 lb.	18.0 lb.	Mk 13 & all Mods
6" Mk 4	6"/47	38.20"	7.85"	Brass	28.2 lb.	32.0 lb.	Mk 13 & all Mods
8" Mk 1	8"/55	50.275"	10.55"	Brass	57.0 lb.	90.0 lb.	Mk 35
20-mm Mk 2	20-mm A.A.	4.343"	0.874"	Brass	0.190 lb.	27.7 grams	Mk 30, Mk 31
20-mm Mks 3 & 4	20-mm A.A.	4.343"	0.874"	Mk 3: Steel	0.190 lb.	27.7 grams	Mk 31
				Mk 4: Brass			
40-mm Mk 1	40-mm A.A.	12.24"	2.441"	Brass	1.93 lb.	300 grams	Mk 21
40-mm Mks 2 & 3	40-mm A.A.	12.24"	2.441"	Mk 2: Brass	Mk 2: 1.89 lb.	300 grams	Mk 22
				Mk 3: Steel	Mk 3: 1.53 lb.		
1.1" Mk 1	1.1" A.A.	7.83"	1.71"	Brass	0.688 lb.	120 grams	Mk 19 Mod 3
1-pdr. Mk 2	1-pounder	5.389"	1.775"	Brass	0.406 lb.	70 grams	Mk 10 Mod 9
3-pdr. Mk 1	3-pounder	14.843"	2.51"	Brass	1.65 lb.	300 grams	Mk 10 Mod 9
6-pdr. Mk 1	6-pounder	12.09"	2.99"	Brass	2.13 lb.	500 grams	Mk 10 Mod 9

SHORT CASES

Type	Gun	Length	Propellant Weight	Primer
Mk 1 (Modified)	1.1"	5.25"	85 grams	Mk 19 Mods 1, 2, & 3
Mk 2 (Modified)	3"/23	4.9"	385 grams	Mk 10 Mod 9
Mk 3 & Mods 2 & 3 (Modified)	3"/50	18"	3.8 lb.	Mk 14
Mk 2 & Mod 3 (Modified)	4"/50	29"	14.0 lb.	Mk 13 & all Mods
Mk 4 (Modified)	5"/25	21"	9.0 lb.	Mk 13 & all Mods
Mk 5 (Modified)	5"/38	16.25"	9.0 lb.	Mk 13 & all Mods
Mk 3 (Modified)	5"/51	20"	10.0 lb.	Mk 13 & all Mods
Mk 6 (Modified)	5"/34	20"	10.0 lb.	Mk 13 & all Mods
Mk 4 (Modified)	6"/47	25.0"	23.0 lb.	Mk 13 & all Mods
Mk 2 (Not Modified)	8"/55	31.08"	44.0 lb.	Mk 35 Mod 1

BAG AMMUNITION

New Dimensions of Powder Sections

Guns Used In	No. of Sections	Diam. of Ignition Circle	Ignition Charge per Section	Full Charge: Diam. of Section Minimum	Full Charge: Diam. of Section Maximum	Full Charge: Length of Section Minimum	Full Charge: Length of Section Maximum	Reduced Charge: Diam. of Section Minimum	Reduced Charge: Diam. of Section Maximum	Reduced Charge: Length of Section Minimum	Reduced Charge: Length of Section Maximum
5"/50 Mks 5 & 6	1	4.00"	75	5.10"	6.00"	28.00"	29.25"				
5"/51 Mks 7, 8, & 15	1	4.00"	75	4.50"	6.00"	29.00"	30.00"	4.50"	6.00"	29.00"	30.00"
6"/47 Mk 17	1	5.00"	150	5.25"	6.50"	33.00"	34.00"	5.25"	6.50"	33.00"	34.00"
6"/50 Mks 6 & 8	1	4.50"	100	5.00"	6.35"	38.00"	39.50"	5.00"	6.35"	38.00"	39.50"
6"/53 Mks 12, 14, & 18	1	5.00"	150	5.25"	6.60"	44.50"	46.50"	5.25"	6.60"	44.50"	46.50"
7"/45 Mk 2	2	5.50"	150	6.50"	8.00"	23.25"	24.00"	6.50"	8.00"	23.25"	24.00"
8"/55 Mks 12, 14 & 15	2	6.00"	200	6.60"	7.80"	27.25"	28.00"	7.20"	7.80"	27.25"	28.00"
12"/50 Mk 7	4	8.50"	300	11.20"	12.60"	18.90"	19.90"	9.10"	10.60"	18.90"	19.90"
12"/50 Mk 8	4	9.00"	300	10.40"	11.50"	18.00"	19.00"	9.80"	10.60"	18.00"	19.00"
14"/45 Mks 8, 10, & 12	4	9.50"	300	12.60"	14.00"	18.75"	19.90"	10.50"	11.50"	18.70"	19.70"
14"/50 Mks 7 & 11	4	9.50"	300	12.60"	14.25"	18.50"	19.70"	10.20"	11.20"	18.70"	19.70"
16"/45 Mk 6–1	6	10.00"	290	13.50"	15.30"	13.75"	15.00"	11.80"	13.20"	14.00"	15.00"
16"/45 Mks 6–2, & 8	5	10.00"	350	13.50"	15.30"	16.75"	18.00"	11.80"	13.10"	17.00"	18.00"
16"/50 Mk 7	6	10.00"	350	13.90"	16.00"	16.00"	17.25"	11.25"	12.40"	16.25"	17.25"

EXISTING SERVICE ROUNDS

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Projectiles Mk	Projectiles Mod	Velocity (F/S)	Type of Charge	Propellent Powder	Charge Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
16"/50	7	0	2,700	A.P.	8	1–6	2,500	Full	SPD	660	Bag (6 Sec.)	Stacked	Bag, Type 3
			2,700	T.	9	1–2	2,500	Full	SPD	660	"	"	"
			2,700	A.P.	8	1–6	1,800	Target	SPD	420	"	"	"
			2,700	T.	9	1–2	1,800	Target	SPDN	340	"	"	"
			2,700	A.P.	8	1–6	1,800	Reduced	SPD	305	"	Dumped	"
									SPDN				
			2,700	T.	9	1–2	1,800	Reduced	SPCG	325	"	"	"
			1,900	H.C.	13	1–3	2,690	Full	SPD	660	"	Stacked	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPD	305	"	Dumped	"
									SPDN				
			1,900	H.C.	13	1–3	2,075	Reduced	SPCG	325	"	"	"
			1,900	H.C.	13	1–3	1,900	H.C.	SPD	325	"	"	"
16"/45	6	1	2,700	A.P.	8	1–6	2,300	Full	SPD	535	Bag (6 Sec.)	Stacked	Bag, Type 3
			2,700	T.	9	1–2	2,300	Full	SPD	535	"	"	"
			1,900	H.C.	13	1–3	2,525	Full	SPD	535	"	"	"
			2,700	A.P.	8	1–6	1,800	Target	SPD	380	"	"	"
			2,700	T.	9	1–2	1,800	Target	SPDN	335	"	"	"
			2,700	A.P.	8	1–6	1,800	Reduced	SPD	295	"	Dumped	"
									SPDN				
			2,700	T.	9	1–2	1,800	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPD	295	"	"	"
									SPDN				
			1,900	H.C.	13	1–3	2,075	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	1,900	H.C.	SPD	290	"	Stacked	"
			1,900	H.C.	13	1–3	1,900	H.C.	SPDN	310	"	"	"
16"/45	6	2	2,240	A.P.	5	1–5	2,520	Full	SPD	545	Bag (5 Sec).	Stacked	Bag, Type 3
	8	0, 1, 2	2,240	T.	6	1	2,520	Full	SPD	545	"	"	"
			1,900	H.C.	13	1–3	2,635	Full	SPD	545	"	"	"
			2,240	A.P.	5	1–5	1,935	Target	SPD	335	"	"	"
			2,240	T.	6	1	1,935	Target	SPD	335	"	"	"

			2,240	A.P.	5	1–5	1,935	Reduced	SPD	295	Bag (5 Sec.)	Dumped	Bag, Type 3
									SPDN				
			2,240	T.	6	1	1,935	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	2,075	Reduced	SPD	.295	"	"	"
									SPDN				
			1,900	H.C.	13	1–3	2,075	Reduced	SPCG	315	"	"	"
			1,900	H.C.	13	1–3	2,000	H.C.	SPD	315	"	Stacked	"
			1,900	H.C.	13	1–3	2,000	H.C.	SPDN	335	"	"	"
14″/50	7	1	1,500	A.P.	16	1–10	2,700	Full	SPD	425	Bag (4 Sec.)	Stacked	Bag, Type 3
	11	1, 2, 3, & 5	1,500	T.	12	3–4	2,700	Full	SPD	425	"	"	"
			1,500	T.	15	1–3	2,700	Full	SPD	425	"	"	"
			1,500	T.	17	1–2	2,700	Full	SPD	425	"	"	"
			1,275	H.C.	19	1–5	2,825	Full	SPD	425	"	"	"
			1,500	A.P.	16	1–10	1,935	Target	SPD	280	"	"	"
			1,500	T.	12	3–4	1,935	Target	SPD	280	"	"	"
			1,500	T.	15	1–3	1,935	Target	SPD	280	"	"	"
			1,500	T.	17	1–2	1,935	Target	SPD	280	"	"	"
			1,500	A.P.	16	1–10	1,935	Reduced	SPDN	195	"	Dumped	"
			1,500	T.	12	3–4	1,935	Reduced	SPCG	200	"	"	"
			1,500	T.	15	1–3	1,935	Reduced	SPCG	200	"	"	"
			1,500	T.	17	1–2	1,935	Reduced	SPCG	200	"	"	"
			1,275	H.C.	19	1–5	2,065	Reduced	SPDN	195	"	"	"
			1,275	H.C.	19	1–5	2,065	Reduced	SPCG	200	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (1)	275 (1)	"	Stacked	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (2)	225 (2)	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (5)	260 (5)	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPDN	245	"	"	"
14″/45	8	1, 3, 4, & 6	1,500	A.P.	16	1–10	2,600	Full	SPD	420	Bag (4 Sec.)	Stacked	Bag, Type 3
	10	1			20	1							
	12	Mods	1,500	T.	17	1–2	2,600	Full	SPD	420	"	"	"
					21	1							
			1,275	H.C.	19	1–5	2,735	Full	SPD	420	"	"	"
			1,500	A.P.	16	1–10	1,935	Target	SPD	285	"	"	"
					20	1							
			1,500	T.	17	1–2	1,935	Target	SPD	285	"	"	"
					21	1							

EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Projectiles Mk	Projectiles Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Propellent Charge Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
14″/45	8	1, 3, 4, & 6	1,500	A.P.	16	1–10	1,935	Reduced	SPDN	205	Bag (4 Sec.)	Dumped	Bag, Type 3
	10	1			20	1							
	12	Mods	1,500	T.	17	1–2	1,935	Reduced	SPCG	210	"	"	"
	(Continued)				21	1							
			1,275	H.C.	19	1–5	2,065	Reduced	SPDN	205	"	"	"
			1,275	H.C.	19	1–5	2,065	Reduced	SPCG	210	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (3)	285 (3)	"	Stacked	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPD (4)	240 (4)	"	"	"
			1,275	H.C.	19	1–5	2,000	H.C.	SPDN	255	"	"	"
12″/50	8	—	1,140	A.P.	18	1	2,500	Full	SPD	275	Bag (4 Sec.)	Stacked	Bag, Type 3
			1,140	T.	19	1	2,500	Full	SPD	275	"	"	"
			940	H.C.	17	1	2,650	Full	SPD	275	"	"	"
			1,140	A.P.	18	1	1,800	Target	SPD	175	"	"	"
			1,140	T.	19	1	1,800	Target	SPD	175	"	"	"
			1,140	A.P.	18	1	1,800	Reduced	SPDN	135	"	Dumped	"
			1,140	T.	19	1	1,800	Reduced	SPDF	135	"	"	"
			940	H.C.	17	1	1,965	Reduced	SPDN	135	"	"	"
			940	H.C.	17	1	1,850	H.C.	SPD	175	"	Stacked	"
			940	H.C.	17	1	1,850	H.C.	SPDN	170	"	"	"
			940	H.C.	17	1	2,435	Special	SPD	245	"	"	"
			1,140	A.P.	18	1	2,300	Special	SPD	245	"	"	"
			1,140	T.	19	1	2,300	Special	SPD	245	"	"	"
			940	H.C.	17	1	1,965	Reduced	SPDF	135	"	Dumped	"
12″/50	7	15–19	870	A.P.	15	6	2,900	Full	SPD	335	Bag (4 Sec.)	Stacked	Bag, Type 3
			870	T.	11	3–4	2,900	Full	SPD	335	"	"	"
					14	2–8							
			740	H.C.	16	1–2	3,000	Full	SPD	335	"	"	"
			870	A.P.	15	6	2,100	Reduced	SPD	225	"	"	"
			870	T.	11	3–4	2,100	Reduced	SPD	225	"	"	"
					14	2–8							
			740	H.C.	16	1–2	2,125	Reduced	SPD	225	"	"	"

8″/55	12	1–2	335	A.P.	21	1–3	2,500	Full	SPD	85	Bag	Stacked	Bag, Type 3
	14	1–2	335	T.	22	2	2,500	Full	SPCG	89	"	"	"
	16	1	260	H.C.	24	1–5	2,700	Full	SPD	85	"	"	"
			260	H.C.	24	1–5	2,700	Full	SPCG	89	"	"	"
			335	A.P.	21	1–3	2,000	Target	SPD	59	"	Dumped	Dwg. 53417
			335	T.	22	2	2,000	Target	SPD	59	"	"	"
			260	H.C.	24	1–5	2,160	Target	SPD	59	"	"	"
			335	A.P.	21	1–3	2,000	Reduced	SPDN	55	"	"	"
			335	T.	22	2	2,000	Reduced	SPDF	56	"	"	"
			260	H.C.	24	1–5	2,220	Reduced	SPDN	55	"	"	"
			260	A.P.	19	1–6	2,800	Full	SPD	89	"	"	"
					16	7,9,10							
			260	T.	18	5–9	2,800	Full	SPCG	92	"	"	"
			260	A.P.	19	1–6	2,300	Target	SPD	66	"		"
					16	7,9,10							
			260	T.	18	5–9	2,300	Target	SPCG	69	"	"	"
			260	H.C.	24	1–5	2,800	Full	SPD	89	"	"	"
			260	H.C.	24	1–5	2,800	Full	SPCG	92	"	"	"
			260	H.C.	24	1–5	2,300	Target	SPD	66	"	"	"
			260	H.C.	24	1–5	2,300	Target	SPCG	69	"	"	"
			260	Com.	14	1	2,800	Full	SPD	89	"	"	"
			260	Com.	15	1	2,800	Full	SPCG	92	"	"	"
					17	1–4							
			260	Com.	14	1	2,300	Target	SPD	66	"	"	"
			260	Com.	15	1	2,300	Target	SPCG	69	"	"	"
					17	1–4							
8″/55	16	0	335	A.P.	21	1–3	2,500	Full	SPD	77	Case	Dumped	Mk 1
									SPDN				
			335	T.	22	1	2,500	Full	SPCG	82	"	"	"
			260	H.C.	24	1–5	2,700	Full	SPD	77	"	"	"
									SPDN				
			260	H.C.	24	1–5	2,700	Full	SPCG	82	"	"	"
			335	A.P.	21	1–3	2,000	Reduced	SPDN	45	"	"	"
			335	T.	22	1	2,000	Reduced	SPDF	46	"	"	"
			260	H.C.	24	1–5	2,220	Reduced	SPDN	45	"	"	"
			260	H.C.	24	1–5	2,220	Reduced	SPDF	46	"	"	"

EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Projectiles Mk	Projectiles Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Propellent Charge Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
7"/45	2	Mods	165	A.P.	6	0–1	2,700	Full	SPD	58	Bag	Dumped	Dwg. 53417
			165	A.P.	10	2	2,700	Full	SPD	58	"	"	"
			165	A.P.	12	1–2	2,700	Full	SPD	58	"	"	"
			165	T.	11	5	2,700	Full	SPD	58	"	"	"
			153	Fld.	7	2–3	2,700	Full	SPD	58	"	"	"
			154	Bbt.	7	2	2,700	Full	SPD	58	"	"	"
6"/53	12	3, 5, 7	105	T.	25	2–3	3,000	Full	SPD	44	Bag	Dumped	Dwg. 53417
	14	0			29	1–4			SPDN*				
	18	1–2	105	T.	30	1–2	3,000	Full	SPCG	46	"	"	"
					25	2–3			SPD				
			105	T.	29	1–4	2,300	Tar. or Red.	SPDN	31	"	"	"
			105	T.	30	1–3	2,300	Tar. or Red.	SPCG	33	"	"	"
			105	Com.	24	1	3,000	Full	SPD	44	"	"	"
									SPDN				
			105	Com.	27	1–8	3,000	Full	SPCG	46	"	"	"
			105	Com.	24	1	2,300	Tar. or Red.	SPD	31	"	"	"
									SPDN				
			105	Com.	27	1–8	2,300	Tar. or Red.	SPCG	33	"	"	"
			105	H.C.	34	1–6	3,000	Full	SPD	44	"	"	"
									SPDN				
			105	H.C.	34	1–6	3,000	Full	SPCG	46	"	"	"
			95	S.S.	22	1	3,000	Full	SPD	44	"	"	"
									SPDN				
			95	S.S.	23	1–2	3,000	Full	SPCG	46	"	"	"
6"/50	6	0	106	Com.& T.	20	0,2,4	2,800	Full	SPD*	38	Bag	Dumped	Dwg. 53417
	8	Mods	106	Com.& T.	20	0,2,4	2,800	Full	SPDN	38	"	"	"
			106	Com.& T.	20	0,2,4	2,100	Target	SPD	26	"	"	"
			106	Com.& T.	20	0,2,4	2,100	Target	SPDN	26	"	"	"
			106	Com.	20	1, 3	2,800	Full	SPD	38	"	"	"
			106	Com.	20	1, 3	2,800	Full	SPDN	38	Bag	Dumped	Dwg. 53417
			96	S.S.	22	1	2,800	Full	SPD	38	"	"	"
			96	S.S.	23	1–2	2,800	Full	SPDN	38	"	"	"

6″/47	17	—	105	Com.	28	1–2	2,800	Full	SPD*	34	Bag	Stacked	Mk 3
			105	Com.	28	1–2	2,800	Full	SPDN*	34	"	Dumped	Dwg. 53417
			105	T.	31	1	2,300	Target	SPD*	26	"	"	"
			105	T.	29	1–4	2,300	Target	SPDN*	26	"	"	"
			96	S.S.	22	1	2,800	Full	SPD	34	"	Stacked	Mk 3
			96	S.S.	23	1–2	2,800	Full	SPDN	34	"	Dumped	Dwg. 53417
6″/47	16	0–1	130	A.P.	35	1–8	2,500	Full	SPD*	33	Semi-Fixed	Dumped	Case Mk 4
									SPDN				
			130	T.	36	1–2	2,500	Full	SPCG	34	"	"	"
					37	1, 3			SPD*				
			105	H.C.	34	1–7	2,665	Full	SPDN	33	"	"	"
			105	H.C.	34	1–7	2,665	Full	SPCG	34	"	"	"
			95	S.S.	32	0	2,700	Full	SPD*	33	"	"	"
									SPDN				
			95	S.S.	32	0	2,700	Full	SPCG	34	"	"	"
			130	A.P.	35	1–8	2,050	Target	SPD	25	"	"	"
			130	T.	36	1–2	2,050	Target	SPDN	25	"	"	"
					37	1, 3							
			130	A.P.	35	1–8	2,050	Reduced	SPDN	21	"	"	"
			130	T.	36	1–2	2,050	Reduced	SPDF	22	"	"	"
					37	1, 3							
			105	H.C.	34	1–7	2,160	Target	SPD	25	"	"	"
			105	H.C.	34	1–7	2,160	Target	SPDN	25	"	"	"
			105	H.C.	34	1–7	2,225	Reduced	SPDN	21	"	"	"
			105	H.C.	34	1–7	2,225	Reduced	SPDF	22	"	"	"
5″/54	16	0	70	Com.	41	0	2,650	Full	SPD	18.5	Semi-Fixed	Dumped	Case Mk 6
									SPDN				
			70	Com.	41	0	2,650	Full	SPDF	19	"	"	"
			70	H.C.	42	1	2,650	Full	SPD	18.5	"	"	"
									SPDN				
			70	H.C.	42	1	2,650	Full	SPDF	19	"	"	"
			70	S.S.	43	0	2,650	Full	SPD	18.5	"	"	"
									SPDN				
			70	S.S.	48	0	2,650	Full	SPDF	19	"	"	"

* May have flashless pellets added. If so, will be marked.

EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	& Mods	Wt. (lb.)	Projectiles Type	Mk	& Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
5″/51	9	Mods	50	Com.& T.	15	5, 12–14	3,150	Full	SPD* SPDN	25	Semi-Fixed	Dumped	Case Mk 3
			50	Com.& T.	15	5, 12–14	3,150	Full	SPDF	26	"	"	"
			50	H.C.	39	1	2,300	H.C.	SPD* SPDN	15.5	"	"	"
			50	H.C.	39	1	2,300	H.C.	SPDF	15.5	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPD* SPDN	25	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPDF	26	"	"	"
5″/51	7 8	Mods Mods	50	Com.–T.	15	5, 12–14	3,150	Full	SPD* SPDN	25	Bag	Dumped	Dwg. 53417
	15	Mods	50	Com.–T.	15	5, 12–14	3,150	Full	SPDF	26	"	"	"
			50	Com.–T.	15	5, 12–14	2,300	Reduced	SPD* SPDN	15.5	"	"	"
			50	Com.–T.	15	5, 12–14	2,300	Reduced	SPDF	15.5	"	"	"
			47	Com.–T.	15	1 & 5	3,150	Full	SPD SPDN	25	"	"	"
			47	Com.–T.	15	1 & 5	3,150	Full	SPDF	26	"	"	"
			47	Com.–T.	15	1 & 5	2,300	Reduced	SPD SPDN	15.5	"	"	"
			47	Com.–T.	15	1 & 5	2,300	Reduced	SPDF	15.5	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPD SPDN	25	"	"	"
			55	S.S.	25	1, 3–6	3,150	Full	SPDF	26	"	"	"
			55	A.A.Com.	35	1–12	2,600	Special	SPD SPDN	22	"	"	"
			55	A.A.Com.	35	1–12	2,600	Special	SPDF	22	"	"	"
5″/50	5	Mods	50	Com.–T.	15	5,12–14	3,000	Full	SPD	21	Bag	Dumped	Dwg. 53417
	6	Mods	50	Com.–T.	15	5,12–14	3,000	Full	SPDN	21	"	"	"

5″/38	12	0–1	54	Com.	32	1–3	2,600	Full	SPD* SPDN/SPDF	15.2/16	Semi-Fixed	Dumped	Case Mk 5
			54	Com.	38	1–3	2,600	"	"	"	"	"	"
			54	Com.	46	1–2	2,600	"	"	"	"	"	"
			55	A.A.Com.	31	1–11	2,600	"	"	"	"	"	"
			55	A.A.Com.	34	10	2,600	"	"	"	"	"	"
			55	A.A.Com.	35	1–12	2,600	"	"	"	"	"	"
			55	A.A.Com.	31	1–11	1,200	Reduced	SPDN	3.6	"	"	"
			55	A.A.Com.	34	10	1,200	"	"	"	"	"	"
			55	A.A.Com.	35	1–12	1,200	"	"	"	"	"	"
			54.5	S.S.	30	1–8	2,600	Full	SPD SPDN/SPDF	15.2/16	"	"	"
			54.5	S.S.	30	1–8	1,200	Reduced	SPDN	3.6	"	"	"
			53	S.S. (W.P.)	30	1–8	2,600	Full	SPD SPDN/SPDF	15.2/16	"	"	"
			53	"	30	1–8	1,200	Reduced	SPDN	3.6	"	"	"
			54.5	S.S. (W.P.)	30	5, 7–8	2,600	Full	SPD SPDN/SPDF	15.2/16	"	"	"
			54.5	"	30	5, 7–8	1,200	Reduced	SPDN	3.6	"	"	"
5″/25	11	1–2 5–8	54	S.S.	25	2	2,155	Full	SPD/SPDN*	9.6	Fixed	Dumped	Case Mk 4 0–2
			54	S.S.	27	1–10	2,155	"	"	"	"	"	"
			54	S.S.	45	0	2,155	"	"	"	"	"	"
			54	A.A.Com.	36	1–4	2,155	"	"	"	"	"	"
			52	A.A. Com.–T.	28	2–14	2,175	"	"	"	"	"	"
5″/25	13 17	0 0–1	54	S.S.	25	2	2,110	Full	SPD/SPDN*	9 6	Fixed	Dumped	Case Mk 4 0–2
			54	S.S.	27	1–10	2,110	"	"	"	"	"	"
			54	S.S.	45	0	2,110	"	"	"	"	"	"
			54	A.A.Com.	36	1–4	2,110	"	"	"	"	"	"
			52	A.A. Com.–T.	28	2–14	2,130	"	"	"	"	"	"
4″/50	9	5–24	33	Com.	6	6	2,900	Full	SPD SPDN/SPDF*	15/16	Fixed	Dumped	Case Mk 2 Mods 0, 1, 3, 4
			33	Com.	10	0–3	2,900	"	"	"	"	"	"
			33	Com.	16	1–2	2,900	"	"	"	"	"	"
			33	Com.	6	6	2,500	Target	"	13	"	"	"

* May have flashless pellets added. If so, will be marked.

EXISTING SERVICE ROUNDS (Continued)

Caliber	Guns Mks	Guns Mods	Wt. (lb.)	Projectiles Type	Projectiles Mk	Projectiles Mod	Velocity (F/S)	Type of Charge	Propellent Charge Powder	Propellent Charge Nominal Weight (lb.)	Description of Charge	Type of Charge Assembly	Bag or Case Designation
4"/50	9	5–24	33	Com.	10	0–3	2,500	Target	SPD SPDN/SPDF*	13	Fixed "	Dumped "	Case Mk 2 Mods 0, 1, 3, 4
	(Cont'd)		33	Com.	16	1–2	2,500	"	"	"	"	"	"
			33	H.C.	15	1	2,900	Full	"	15/16	"	"	"
			33	H.C.	15	1	2,500	Target	"	13	"	"	"
			34	H.C.	EX2	0–1	2,900	Full	"	15/16	"	"	"
			34	H.C.	EX2	0–1	2,500	Target	"	13	"	"	"
			35	S.S.	14	1–6	2,900	Full	"	15/16	"	"	"
			35	S.S.	14	1–6	2,500	Target	"	13	"	"	"
3"/50	3	Mods	13+	S.S.	21	1–3	2,700	Full	SPD/SPDN*	4.0	Fixed	Dumped	Case Mk {3;0,2,3; 7;—; 9;—}
	18–22	"	13+	S.S.	24	1	2,700	"	"	"	"	"	"
			13+	S.S.	25	1	2,700	"	"	"	"	"	"
			13+	A.A.	23	1–3	2,700	"	"	"	"	"	"
			13+	A.A.	27	1–4	2,700	"	"	"	"	"	"
			13−	A.A.	31	1	2,700	"	"	"	"	"	"
			13+	A.P.	29	1–2	2,700	"	"	"	"	"	"
3"/23	14	1	13	Com.	3	7	1,650	Full	SPD/SPDN*	580 gms.	Fixed	Dumped	Case Mk 2
			13	S.S.	22	1–5	1,650	"	"	"	"	"	"
			13	S.S.	28	1	1,650	"	"	"	"	"	"
			13	A.A.	26	1–2	1,650	"	"	"	"	"	"
1.1"	1	0–1	0.917	A.A.	1	Mods	2,700	Full	SPDN	120 gms.	Fixed	Dumped	Case Mk 1
40-mm	1	0	1.985	A.A.	1/2	Mods	2,890	Full	SPDN	300 gms.	Fixed	Dumped	Case Mk {1;—; 2; 0–1; 3;—}
			1.96	A.P.	M81	Mods	2,890	"	"	"	"	"	
20-mm	4	0–1	0.2714	H.E.–H.E.I.	3	Mods	2,740	Full	SPDN	27.7 gms.	Fixed	Dumped	Cases Mks 2, 3, 4
			0.2621	H.E.–T.	4	Mods	2,740	"	"	"	"	"	"
			0.2741	H.E.–T.	7	Mods	2,740	"	"	"	"	"	"
			0.2686	A.P.–T.	9	Mods	2,740	"	"	"	"	"	"

* May have flashless pellets added. If so, will be marked.

Part I — Chapter 3

PROJECTILE FUZES

Section I — INTRODUCTION

Time fuzes

A time fuze is a device to detonate a projectile after a predetermined interval of flight. The detonation is accomplished through the burning of a variable length of powder train or through the action of a spring or a centrifugal clock mechanism. Only the clockwork types are currently in use by the U.S. Navy. Powder-train fuzes were previously used but have been declared unserviceable and obsolete.

Proximity fuzes—V.T.

V.T. fuzes are automatic proximity fuzes designed to cause detonation of a projectile at a most advantageous distance from its target. Operating with equal effectiveness in daylight or at night, they require no setting or adjustment before using, eliminating time-of-flight error. They are electrical fuzes which activate the auxiliary detonating fuzes after electrically integrating two factors: (1) nearness to an object, and (2) rate of approach to the object. Both conditions must be fulfilled to a definite degree before an electric impulse in the fuze will discharge a charged condenser through an electric detonator, called a "squib."

V.T. fuzes may be employed for antiaircraft purposes or for barrage fire against land or surface targets where air bursts will be effective against personnel and unarmored structures and equipment.

V.T. antiaircraft fuzes are designed to detonate the projectile at the most advantageous point upon approach to an aircraft, if they pass close enough to insure good probability of lethal fragmentation. The fuzes, moreover, will not normally function until the target is within the umbrella-shaped cone of fragmentation of the round.

An advantage of V.T. fuzing for A.A. work lies in its sensitivity to the presence of its target and the resulting increase of effective target area. The V.T. fuze comprehends a medium bomber as a target about 7,000 square feet in area. The plane presents an actual surface of about 200 square feet.

Wave suppression: One disadvantage encountered with early Mods of the V.T. Fuzes Mk 32 and Mk 45 was their sensitivity to waves or choppy water, causing either premature or non-functioning errors when fired at low elevations at targets near the water. A wave-suppression feature has been incorporated in later models of V.T. fuzes, to eliminate this disadvantage. This feature also makes the fuze less sensitive to large targets, such as land or water, so that detonation will not occur until the fuze is within 10—20 feet of the surface.

Tracer influence: A second disadvantage in the use of V.T. fuzes is that no tracer may be employed, since the burning tracer will influence the fuze to cause functioning upon arming, or to prevent functioning until the tracer has burned out.

Prematures: All V.T. fuzes are subject to random premature bursts along the trajectory after arming but before approaching a target. This makes the fuze somewhat dangerous to use for bombardment fire to cover landing operations, as the prematures will occur over our own forces. However, other advantages of V.T. fuzes for this type of fire are deemed to outweigh this danger. Normal bursts against land installations will be obtained between 10—30 or 50—200 feet above the target respectively, for fuzes with and without the wave-suppres-

sion feature. The fuze will automatically adapt itself to varying terrain features.

Safety features: Because of the number and variety of safety features incorporated, V.T. fuzes are among the safest in use as regards handling, bore safety, and freedom from muzzle bursts. In addition to the bore and muzzle safety provided by the auxiliary detonating fuze, a centrifugal clock is incorporated in the V.T. Fuzes Mks 32 and 40. The V.T. Fuze Mk 45 and later models contain mercury short circuits across the squib in place of the centrifugal clockwork mechanism. These mercury unshorters are so designed that handling, tumbling, or shock will not cause them to open. Centrifugal force caused by the projectile rotation must be applied for 0.2—0.4 seconds, depending on the fuze, before the mercury shorts can be opened. Also, these models incorporate a centrifugal switch which prevents charging of the firing condenser except when the round is rotating at or above a certain rate. This is called the "centrifugal handling switch."

All V.T. projectile fuzes, except the V.T. Fuze Mk 32, are powered with reserve batteries, wet batteries with the active ingredients contained in a glass ampoule until the round is fired. Upon set-back, the ampoule is broken, and the battery is automatically activated.

The battery ampoule is the weakest part of the fuze from the handling standpoint. While the complete round may be dropped 40 feet on armor plate without making it unsafe to fire, the fuze cannot be expected to function porperly. Battery ampoules in the V.T. Fuze Mk 53 will withstand a four-foot drop against armor plate in any position without breakage or impaired functioning. Ampoules in the V.T. Fuzes Mk 32 Mod 30 and Mk 40 may be broken by a two-foot drop on armor plate. If the ampoule is broken a considerable time before firing, the round will probably not function. If the ampoule breaks less than 30 seconds before firing, normal functioning may be expected.

V.T. fuzes operate effectively over a temperature range of 10° to 120° F. Outside this range, a higher percentage of malfunctioning will occur.

Storage: Exposure to high humidity conditions in storage reduces the service life of these fuzes. The V.T. Fuze Mk 32 requires special treatment, as it is not a reserve-battery fuze. The V.T. Fuzes Mk 32 Mods 1—20 & Mod 40 are re-energized by special Bureau of Ordnance personnel about every six months.

Supply: V.T. fuzes are supplied in specially cavitized projectiles for Naval use, and the fuzes cannot be interchanged with nose time or point detonating fuzes. V.T. fuzes are ballistically similar to nose time fuzes, so no corrections need be made in practical fire control when V.T. fuzing is employed. Although all V.T. fuzes have formerly been supplied in complete rounds, the V.T. Fuze Mk 58 will be issued to replace previously fitted V.T. Fuzes Mk 45 Mod 12 in 3"/50 A.A. projectiles.

Point, base, and auxiliary detonating fuzes

When classified according to assembled position in the projectile, fuzes are either "point" fuzes, which are assembled in the nose of the projectile, or "base" fuzes. "Auxiliary detonating" fuzes are used in conjunction with point fuzes in all except Illuminating projectiles.

Ignition and detonating fuzes

The differentiation between "ignition" and "detonating" fuzes depends on the method of firing the bursting charge. The operating mechanism of the ignition fuze fires a black-powder magazine, which may ignite the bursting charge of the projectile directly or function through an auxiliary detonating fuze, containing a detonating element. A detonating fuze contains a high-explosive element within its own body.

Delay

The delay elements within impact fuzes consist either of slow-burning powder pellets of fixed size or pellets in which varying lengths burn before the action takes place. The delay element is designed to allow penetration of targets before bursting of the projectile. Delays are always used in armor-piercing projectiles to obtain complete penetration before detonation. Instantaneous fuzes are employed against light armor or material targets for burst before penetration.

Arming

The principal forces used in arming or preparing fuzes for action are (1) set-back, the force of inertia or resistance to linear acceleration of projectiles, and (2) centrifugal force, due to the rotation of the projectile. Many of the Navy fuzes employ a combination of these two forces in arming the fuze. The force of set-back exists only during the acceleration stage of the projectile's flight, which ceases when the projectile leaves the bore of the gun. Centrifugal force, however, exists from the instant that the projectile begins its movement until detonation occurs. Set-back is generally used to shear safety pins, fire percussion elements, and initiate the operation of mechanical clocks. Centrifugal force serves to release detents or locking pins, drive and fire centrifugally operated clocks, revolve rotor blocks, etc., as is explained in detail in the individual fuze sections following.

Part I — Chapter 3 — Section 2

POINT DETONATING FUZES FOR PROJECTILES

Mk 7 Mod 1 (Obsolete)

Projectiles used in	7"/45 Field and Bbt.
Over-all length, inches	7.81
Diameter, inches	Body: 1.12 Base of ogive: 1.62
Threaded length, inches	1.27
Threads	13 R.H.
Material	Steel

Description: This fuze consists of a long, cylindrical body closed at either end by an ogival nose cap and a cylindrical base plug, each threaded into place. The central cavity of the body houses a safety spring, a long percussion rod assembly, a needle striker, a striker retaining sleeve, a detonator, and a ring booster pellet.

The percussion rod is closed at its upper end by a metal cap. The rolled edges of this cap and the safety spring tend to prevent the percussion rod from moving into the upper portion of the body. The long cylindrical portion of the percussion rod is slotted longitudinally to allow the eared striker to slide freely within the rod. The ears of the striker are engaged by the striker retaining sleeve, holding the striker permanently fixed. A detonator is fixed to the lower end of the percussion rod. In the unarmed position, this detonator is not adjacent to the ring booster charge but is encased in a safety chamber in the base of the fuze. Accidental explosion of the detonator in this position would

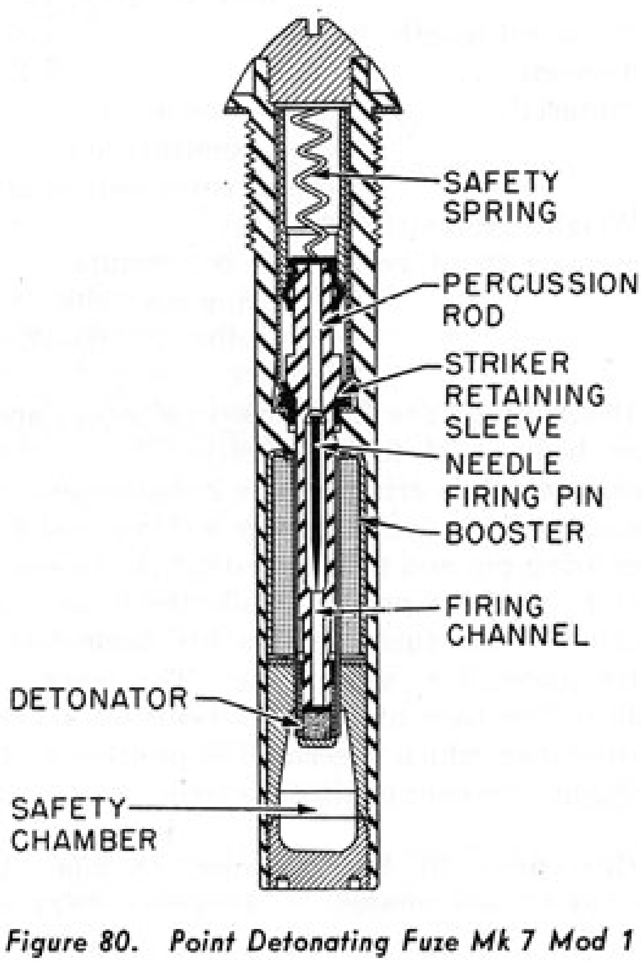


Figure 80. Point Detonating Fuze Mk 7 Mod 1

spend itself harmlessly in the expansion chamber, and the booster charge would not be fired.

Operation: The fuze functions entirely on impact, when the inertia of the percussion rod drives the rolled edges of its upper cap past the shoulder of the cap retaining sleeve. The rod then continues into the upper portion of the fuze body, against the force of the safety spring. This action carries the detonator out of the safety chamber, adjacent to the ring booster, and against the fixed firing pin. The initiation of the detonator fires the booster and the main charge.

Rearward motion of the percussion rod during set-back is prevented by the conical shape of the percussion rod just above the striker retaining sleeve.

Mk 12 Mods 0—3

Projectiles used in .... 1.1" A.A.
Over-all length, inches 2.3
Diameters, inch ...... Firing pin head: 0.18
Base of ogive: 1.08
Threaded length, inch 0.62
Threads .... 7 R.H.
Material .... Nose—aluminum
Base—commercial brass
Booster cover—sheet steel
Weight, grams 85.3
Arming speed, revolutions per minute
Firing pin: 5000–7500
Rotor: 10,000–12,000

Description: The fuze consists of a nose and a fuze body, held firmly together by a metal jacket, which is crimped over at both ends, and separated from each other by a thin metal disc. The firing pin and firing pin detents are assembled in the nose portion, while the lower body portion of the fuze contains the rotor detent, rotor, detonator, and booster. The booster is held in the base of the fuze body by a metal closing disc, which is secured in position by the crimped-over ends of the fuze body.

Operation: In the unarmed position, the striker is held upward by a pair of firing pin detents, and the detonator rotor is held out of alignment with the firing pin and the booster lead-in by a rotor detent. When the projectile is fired from the gun, centrifugal force moves the firing pin and rotor detents outward against their springs, unlocking the firing pin and the rotor. Centrifugal force then causes the rotor to revolve about its pivot until brought up by the stop pin. In this position, the detonator is fully aligned with the firing pin and the booster lead-in. On impact, the exposed firing pin is driven into the detonator, which initiates the booster lead-in and the booster. The fuze is designed to function on light duralumin sheets.

Remarks: The Point Detonating Fuze Mk 12 Mod 1 is identical to the Mk 12, except that an extra striker-support piece is set in a groove in the nose. Mods 0 and 1 are now obsolete. Mods 2 and 3 differ from Mod 1 in that the striker is held in the nose assembly by crimping over the end of the nose. In the modified Mk 12 (Mods 2 and 3), to decrease the sensitivity of the fuze, a washer has been placed above the firing pin, and the firing pin has been crimped above the washer. Thus on impact, both the crimp and the washer must be broken.

Mk 26 Mods 0—2

Projectiles used in ...... 20-mm H.E., H.E.I., and H.E.T. (A.A.)
Over-all length, inches 1.016
Diameters, inch ...... Nose—0.35
At base of ogive—0.80
Threaded length, inch .... Mk 26 Mod 0—0.18
Mk 26 Mod 1—0.26
Threads .... Mk 26 Mod 0—4 R.H.
Mk 26 Mod 1—7 R.H.
Weights, grams .... Mk 26 Mod 0—24.67
Mk 26 Mod 1—23.37
Mk 26 Mod 2—28.67
Material .... Mk 26 Mod 0—all brass
Mk 26 Mod 1—zinc body
Mk 26 Mod 2—all brass

Description: Point Detonating Fuze Mk 26 Mod 0 consists essentially of the following parts: The nose or body unit (into which is fitted the rear disc or air channel) and the closing unit, which contains the detonator.

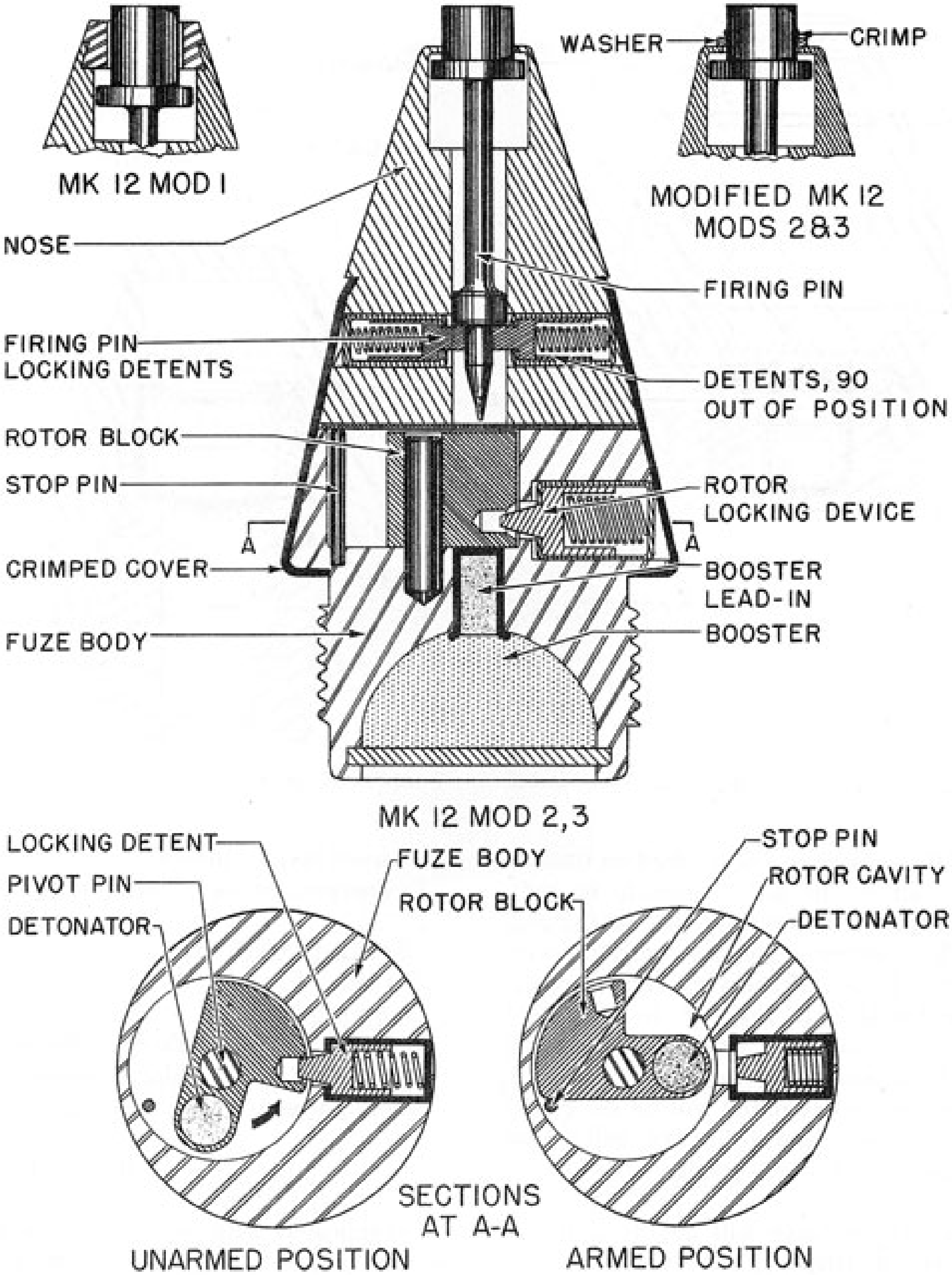


Figure 81. Point Detonating Fuze Mk 12 Mods 0—3

The Point Detonating Fuzes Mk 26 Mods 1 and 2 consist essentially of two pieces: (1) the nose or main body and (2) the magazine, which contains the same detonator used in the Point Detonating Fuze Mk 26 Mod 0 and an additional booster of tetryl below the lead azide detonator.

Operation: The fuze has no safety features in its design, but it will withstand a 40-foot drop onto armor plate without detonation. In the

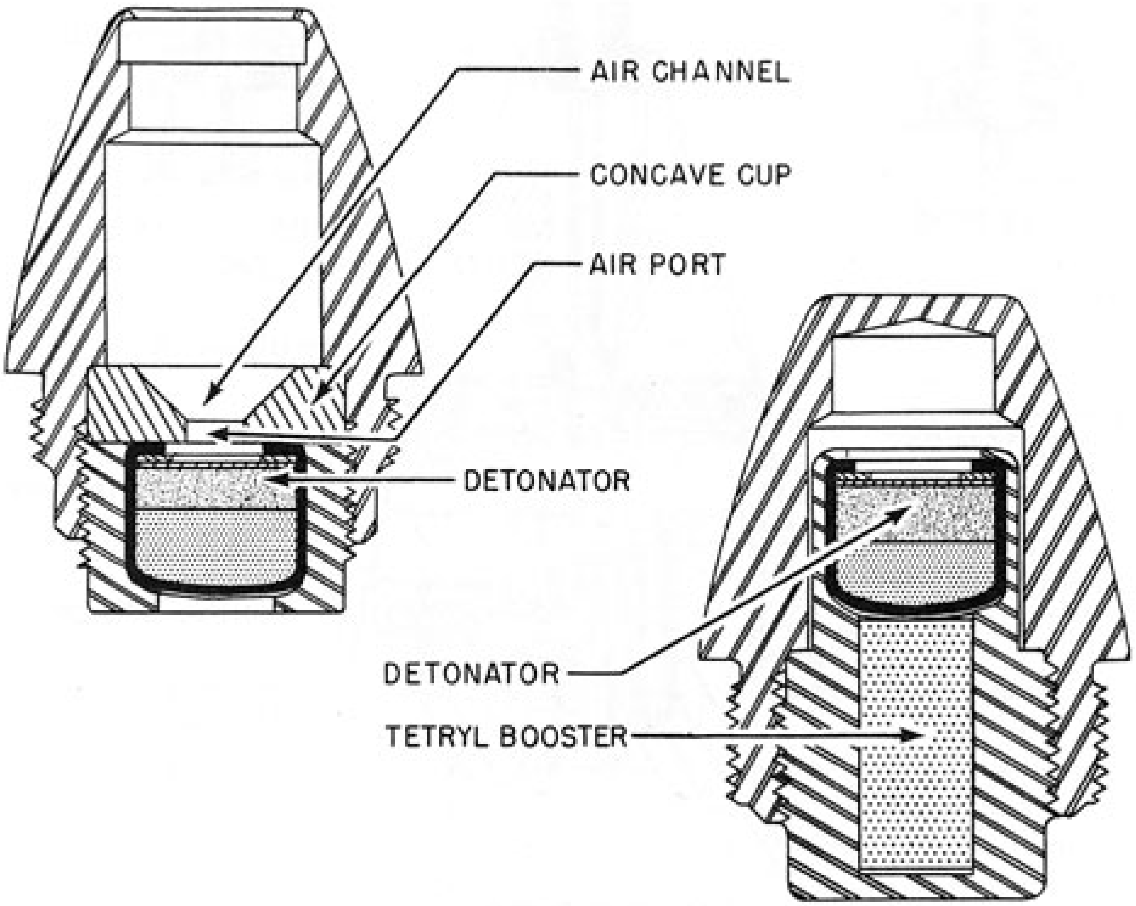


Figure 82. Point Detonating Fuze Mk 26 Mods 0—2

Mk 26 Mod 0, the nose cap is crushed on impact, causing the air in the air channel to be compressed and forced through the hole in the concave disc. This action generates sufficient pressure and heat to set off the very sensitive lead azide detonator beneath the disc. In the Mod 1 and Mod 2, there is no air channel or disc, and the fuze is fired entirely by the shock of impact. The very sensitive detonator will be set off by the shock of impact; and it, in turn, will set off the magazine of tetryl beneath it.

Remarks: These fuzes will not detonate on water impact, but they will detonate on 1/8-inch mild-steel. The Mods 1 and 2 are more sensitive than the Mod 0 to both impact and heat. No more Point Detonating Fuzes Mk 26 Mod 2 are being made.

Mk 27 Mods 0 and 1

Projectiles used in
40-mm A.A., H.E. and H.E.-I.

Over-all length, inches 2.445
Diameters, inches. . . . Nose—0.344
At base of ogive—1.28
Threaded length, inch 0.307
Threads . . . . 4 R.H.
Weight, grams . . . . 104 ± 2.6
Material. . . . . Body—die-cast aluminum
Magazine—brass or steel
Arming speed, r.p.m. . . . Firing pin:
7,000–20,000
Rotor: 10,000–14,000

Description: Internally, the fuze consists of two major housings: the firing pin housing and the rotor housing. Within the firing pin housing is a metal firing pin held in place by two firing pin detents which are surrounded by a circular copper band acting as a detent spring. Above the firing pin housing is a plastic firing pin extension which serves as a safety feature in the event that the fuze is dropped in the unarmed condition. The rotor housing consists of a

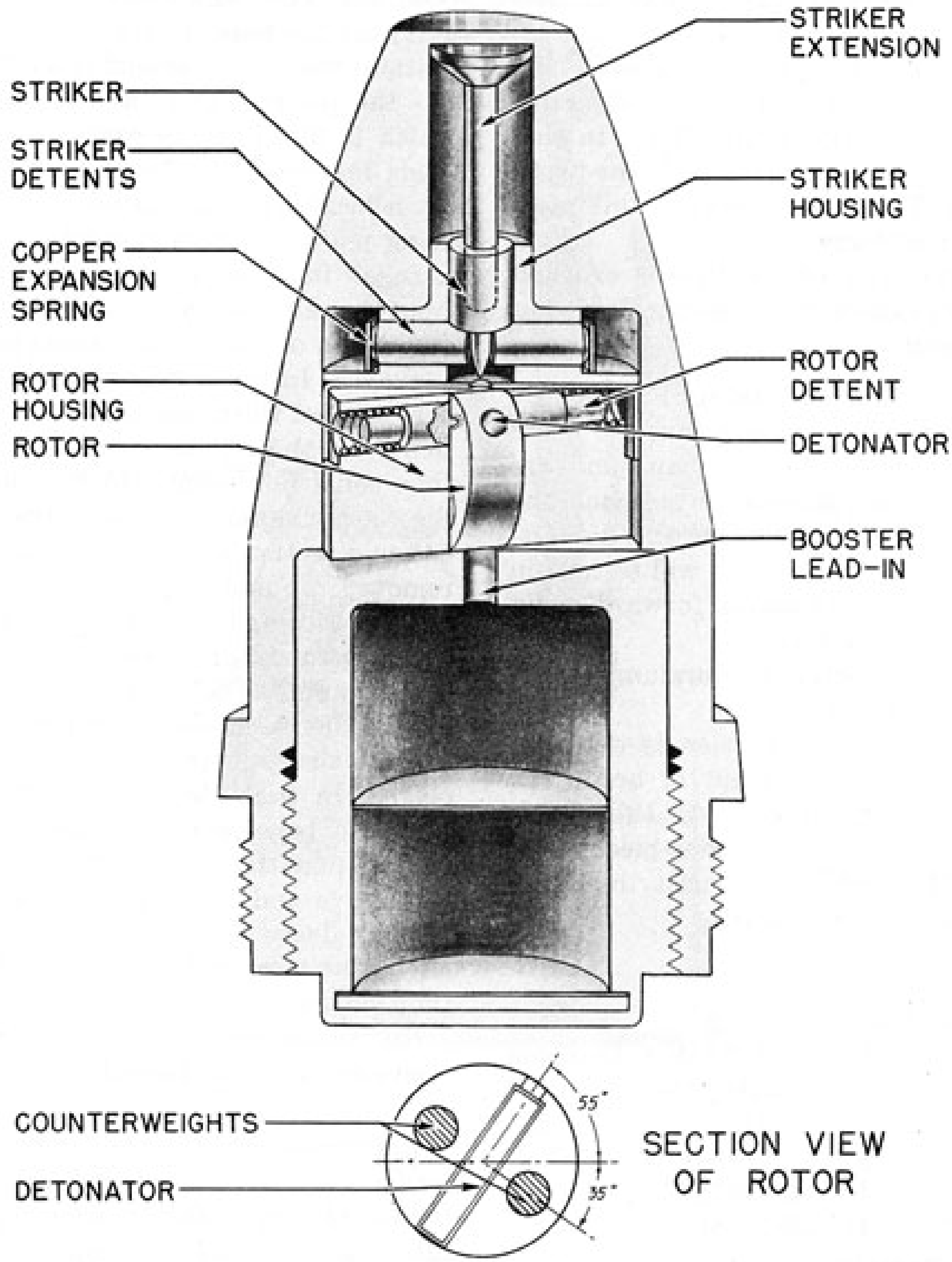


Figure 83. Point Detonating Fuze Mk 27 Mod 0

rotor, with lead counterweights and detonator assembled in a rotor block. The axis of the detonator is inserted at an angle of about 55 degrees to the axis of the fuze. The line of center of the lead counterweights, being perpendicular to the axis of the detonator, is at an angle of about 35 degrees to the axis of the fuze. The rotor is held in this unarmed position by the two rotor detents, the tapered ends of which engage in the holes in the side of the rotor. In this position the detonator is not in line with the firing pin or booster.

Operation: This fuze is armed entirely by centrifugal force which accomplishes three things:

1. The firing pin detents are moved outward against the copper band, thus freeing the firing pin. The copper band is arranged so that the ends of it overlap, allowing room for expansion.

2. The rotor detents are moved back against their spring, freeing the rotor.

3. The lead counterweights are caused to turn the rotor until they are at a maximum radius from the axis of rotation of the fuze. In this position, the detonator is aligned with the firing pin and booster. The rotor is held in this position by centrifugal force.

On impact, the nose of the fuze is crushed and the firing pin extension pushes the firing pin into the detonator.

Remarks: The Point Detonating Fuze Mk 27 Mod 1 differs from the Mod 0 in that the firing pin detents are of a different shape and are known as "hour-glass" detents. On set-back, the firing pin will move back against the detents, and, because of their shape, they will be held in place until the firing pin moves forward again under the influence of creep.

These fuzes will function on duralumin sheet but not on water impact.

The plastic firing pin extension is designed as a safety device in the event of accidental dropping. If the round is dropped, the plastic extension will shatter, wheras a one-piece metal firing pin might force its way past the firing pin detents and initiate the fuze.

Mk 29 Mods 0—3

Projectiles used in
- 5"/25/38/51 A.A. Common
- 5"/38 W.P. (Mod 3 only)
- 5"/51 H.C., 6"/47 H. C.
- 8"/55 H.C., 12"/50 H.C.
- 14"/45/50 H.C.
- 15"/45/50 H.C.

Over-all length, inches	4.15
Diameter at nose, inch	0.55
Diameter at base of ogive, inches	3.00
Threaded length, inch	0.80
Threads	7 R.H.
Weight, pounds	1.45±0.04
Material	Base—steel Detonator body—brass Ogive—plastic
Arming speed, r.p.m.	1,500—2,000

Description: The fuze consists of four principal parts: (1) the base, which contains the relay detonator and holder and the interruptor unit; (2) the nose or detonator assembly, which contains the striker assembly and the detonator; (3) the plastic ogive; and (4) the flash tube, which is fitted in the center of the ogive and holds the nose and the base together. A crush cup is located beneath the firing pin, holding the firing pin away from the detonator, and a centrifugal interruptor separates the detonator from the relay detonator in the base of the fuze. Two types of interruptor assemblies have been employed. In the earlier model, the interruptor bore against the upper blade of a forked setting sleeve in the "Delay" or "Off" position and thus could not move into the sleeve and clear the flash channel. Rotating the sleeve 90° in either direction to the "S.Q." or "On" position removed the end of the forked blade from the interruptor, and centrifugal force could move the interruptor into the sleeve and out of the flash channel. The interruptor system of later models has been slightly altered. A cylindrical setting sleeve with an eccentric bore is employed. In the "Delay" or "Off" position, the eccentric bore is not aligned with the interruptor, and the interruptor cannot move into the sleeve and clear the channel. Turning the setting sleeve to the "S.Q." or "On" position aligns the bore with the interruptor, which can then be moved into the sleeve by centrifugal force. In either case, the end of the setting sleeve carries a slotted setting key.

Operation: When the fuzed projectile is loaded into the gun, the setting key is turned to the "On" or "S.Q." position. On set-back, the interruptor sits down in the flash channel, but when the projectile leaves the gun centrifugal force moves the interruptor into the sleeve and clears the flash channel. On impact, the closing disc above the striker is forced down, the crush cup beneath the striker is crushed, and the striker is driven into the detonator. The flash travels through the open flash channel and initiates the relay detonator in the base of the fuze.

Remarks: The differences between Mods of this fuze are as follows:

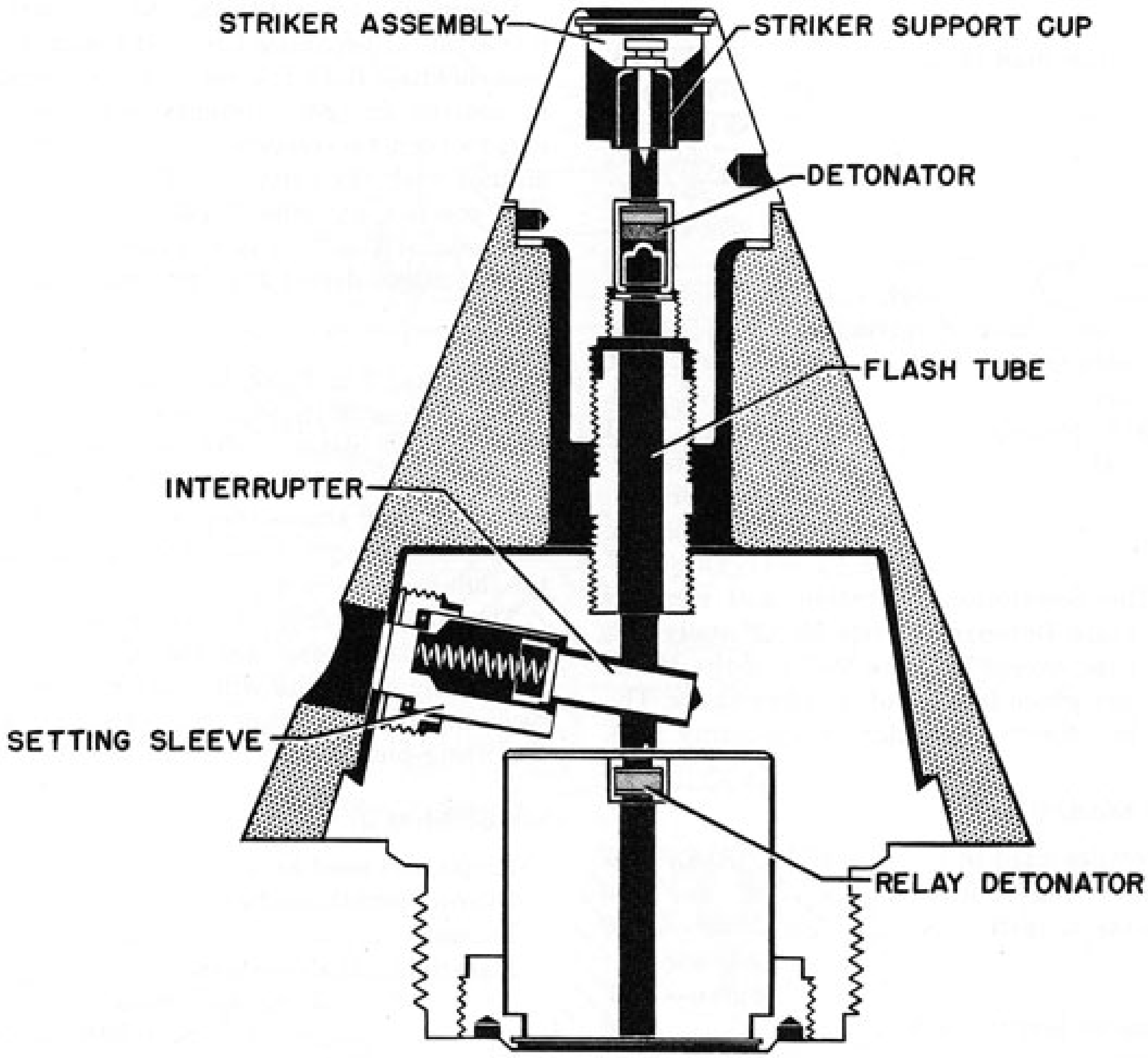


Figure 84. Point Detonating Fuze Mk 29 Mod 0

Mod 0: Dark green ogive, made of easily chipped asbestos plastic, unsuitable for storage and handling. This Mod is obsolete.

Mod 1: Chip-proof, resin-impregnated cloth, yellow plastic ogive.

Mod 2: Same as Mod 1, with strengthened flash channel.

Mod 3: Like Mod 2, with longer nose cap extending to base and giving additional support to flash channel. Brown plastic ogive. A 0.01-inch thick disc is incorporated between the relay detonator and the flash channel of the Mod 3. This prevents gas pressure, which sometimes leaks past the unarmed interruptor, from setting off the relay detonator, if the nose of the fuze is accidentally struck during handling.

This fuze will function on thin plate and on water at angles over 6°.

Mk 30

Projectiles used in	3"/23 A.A. 3"/50 A.A. 3"/50 H.C. 4"/50 H.C. 5"/54 H.C. 6"/47 H.C.
Over-all length, inches	4.55
Diameter at nose, inch	0.55
Diameter at base of ogive, inches	2.4
Threaded length, inch	0.80
Threads	7 R.H.
Weight, pounds	1.51
Material	Base—Steel Head—brass Ogive—plastic

All the description, operation, and remarks on the Point Detonating Fuze Mk 29 apply also to this fuze, except that the Mod 1 of the Mk 30 has a light green instead of a yellow ogive. The Mk 30 is a Navy adaptation of the Army M48.

Mk 34 Mods 0 and 1

Projectiles used in	1.1" A.A., H.E.
Over-all length, inches	2.08
Diameters, inch	Nose—0.300 At base of ogive—1.06
Threaded length, inch	0.46
Threads	7 R.H.
Material	Body—die-cast alloy (zinc base) Magazine—brass Firing pin extension—plastic

Description: This fuze consists of one housing containing the firing pin and rotor units. Above the firing pin is a plastic firing-pin extension. The firing pin is held up by two detents, which are held in place by a circular copper band surrounding them and acting as a spring. Beneath the firing pin is the rotor, with the detonator at an angle of about 55 degrees from the axis of the fuze. The rotor is held in the unarmed position by a set-back block connected by a copper shear wire. In this position, the detonator is out of line with both the firing pin and the booster.

Operation: On set-back, the set-back block moves back, breaking the shear wire that has been holding it to the rotor. Centrifugal force causes the firing-pin detents to move outward and to turn the rotor so that the detonator is aligned with the firing pin. The rotor is held in this position by centrifugal force. On impact, the nose of the fuze is crushed and the firing pin extension drives the firing pin into the detonator.

Remarks: The Point Detonating Fuze Mk 34 Mod 1 differs in that the firing pin detents are "hour-glass" detents. On set-back, the firing pin will move back against the detents, and (because of their shape) they will be held in place until the firing pin moves forward again under the influence of creep.

The plastic firing-pin extension is a safety device. In the event that the round is dropped, the plastic extension will shatter, where a one-piece metal firing pin might force its way past the firing-pin detents and initiate the fuze.

Mk 66 Mod 0

Projectiles used in	5"/38 W.P.
Over-all length, inches	4.408
Thread	1.70"-14NS-1 R.H.
Materials	Body—steel Nose piece—brass Ogive—plastic (cloth base) Rotor assembly—aluminum alloy Magazine—steel
Weight, pounds	1.54

Description: This fuze is very much like the Point Detonating Fuze Mk 29 Mod 3, with the addition of the rotor for detonator safety. It has the firing pin and crush cap in the nose, the flash channel, the interruptor device, the rotor assembly, and the magazine. The rotor contains a lead azide detonator and is held in place by two detents. The booster magazine contains 6.7 grams of black powder in a water-tight vinylite cup. A vinylite cup is cemented onto the base of the fuze to prevent the holes in the metal cover from abrading the silk powder bags in the W.P. load as the fuze is inserted.

An aluminum disk 0.010-inch thick between

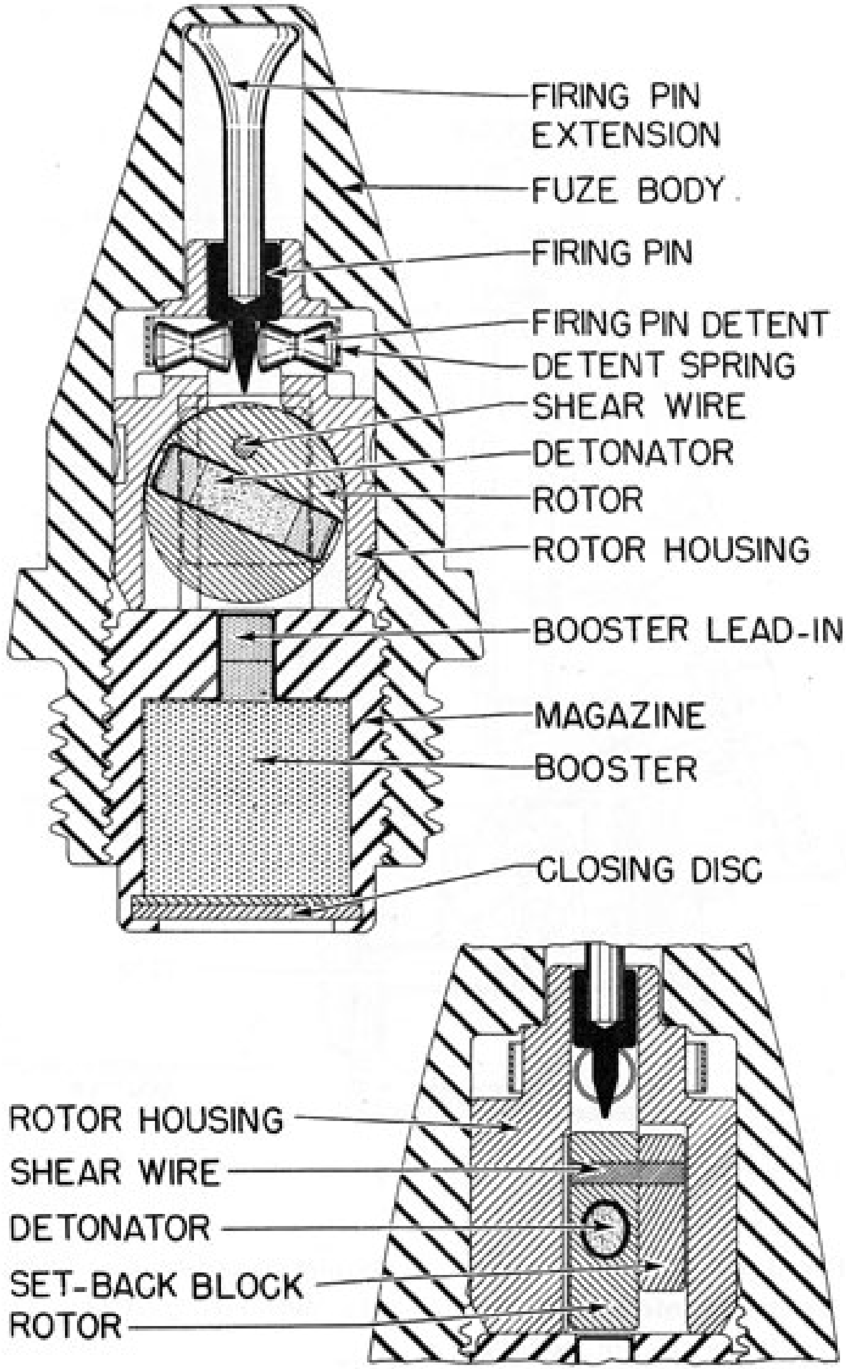


Figure 85. Point Detonating Fuze Mk 34 Mod 1

the relay detonator and the rotor housing is another safety feature. It prevents pressure from an accidental detonation in the nose from getting to the rotor after leaking past the unarmed interruptor—which the gas could do.

Operation: When the projectile is ready to be fired, the setting screw for the interruptor is turned to the ON or SQ ("Super-Quick") position. Up to this time the interruptor, in the OFF position, has blocked the flash channel so that accidental crushing of the cup, setting off the detonator, could not set off the booster charge. On set-back, the interruptor sits down in the flash channel; but, as creep takes over, the centrifugal force moves the interruptor into the sleeve, clearing the flash channel.

Centrifugal force also moves the detents holding the rotor out, allowing the lead counter-

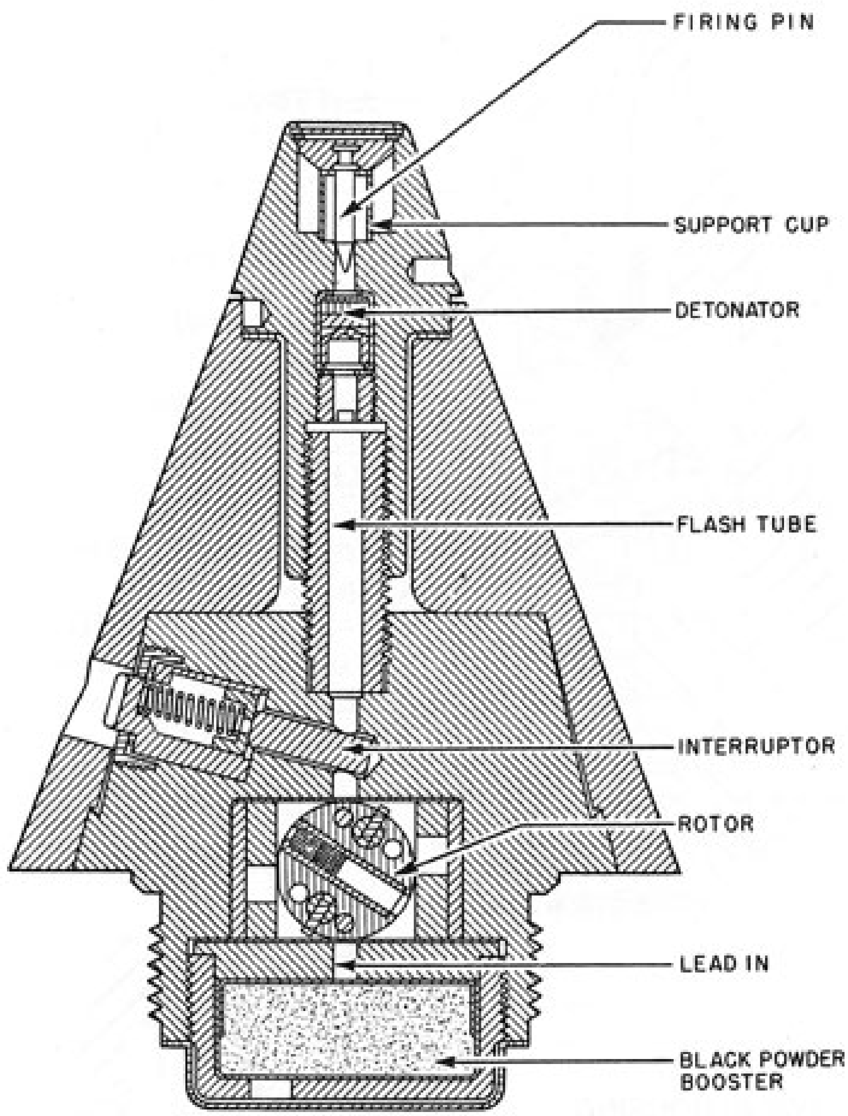


Figure 86. Point Detonating Fuze Mk 66 Mod 0

weights in the rotor, through centrifugal force, to rotate the rotor until the stop pins rest against the edge of the holes in the housing, thus lining up the second detonator under the flash channel. The fuze is now fully armed, and, on impact, the crush cap collapses, allowing the firing pin to set off the detonator, sending the flash down the open tube, which in turn sets off the detonator in the rotor, and finally the black powder charge.

Remarks: The fuze will detonate on impact with ground, ½-inch wood, or ⅛-inch mild steel plate.

The Point Detonating Fuze Mk 66 was developed to give detonator safety in 5"/38 W.P. projectile assemblies, which do not have auxiliary detonating fuzes.

M75

Projectiles used in	20-mm (Army) H.E.–I., M97
Over-all length, inches	1.20
Diameter at base of ogive, inch	0.64
Threaded length, inch	0.20
Threads	7 R.H.
Weight, pound	0.0497
Material	Brass
Filling	Detonator—mercury fulminate Relay charge—lead azide Booster—tetryl

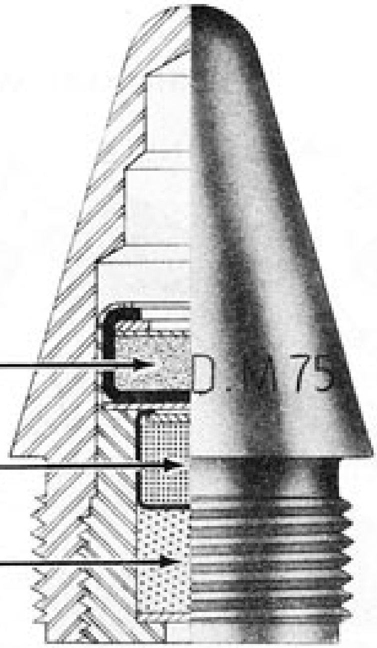


Figure 87. Point Detonating Fuze M75

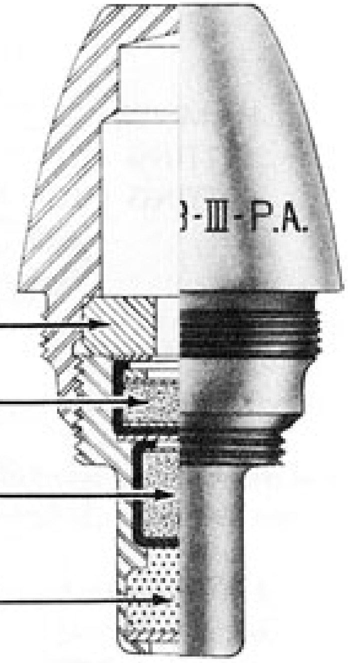


Figure 88. Point Detonating Fuze No. 253 Mk 3

Description: This fuze is designed to function with instantaneous action on impact with light material surfaces. The fuze is initiated on impact by the set-forward motion of the detonator charge, or by pieces of metal from the body striking the detonator charge.

The fuze has two major parts, a body with an air space in the fore part of the fuze, and a magazine containing the explosive train, screwed into the base of the body.

Remarks: The fuze contains no interruptors or other safety devices and is, therefore, sensitive for handling.

No. 253 Mks I—3

Projectiles used in	20-mm (Army) H.E.–I., Mk 1
Over-all length, inches	1.41
Diameter at nose, inch	0.32
Diameter at base of ogive, inch	0.70
Threaded length, inch	0.12
Threads	4 R.H.
Weight, pound	0.058
Material	Brass
Filling	Detonator—mercury fulminate Relay charge—mercury fulminate Booster—tetryl

Description: This fuze is designed to function with instantaneous action on impact with light material surfaces. It is initiated on impact by the set-forward force of the detonator charge, or by pieces of metal from the body striking the detonator charge.

The fuze consists of two major parts, a brass body with an air chamber in its forward part, and a brass mazagine containing the explosive train and externally threaded (L.H.) to screw into the base of the body. The magazine is covered with a brass disc separating the detonator from the air column. In the Point Detonating Fuze Mk 1, this disc is solid, but in the Mks 2 and 3 a small hole is drilled through the center of the disc to increase the fuze's sensitivity. In the Mks 1 and 2 the body cavity was closed at the forward end by a thin brass disc; in the Point Detonating Fuze Mk 3, the brass disc is omitted, and the nose is solid across this area.

Remarks: The fuze contains no interruptors or other safety devices, and is therefore sensitive for handling.

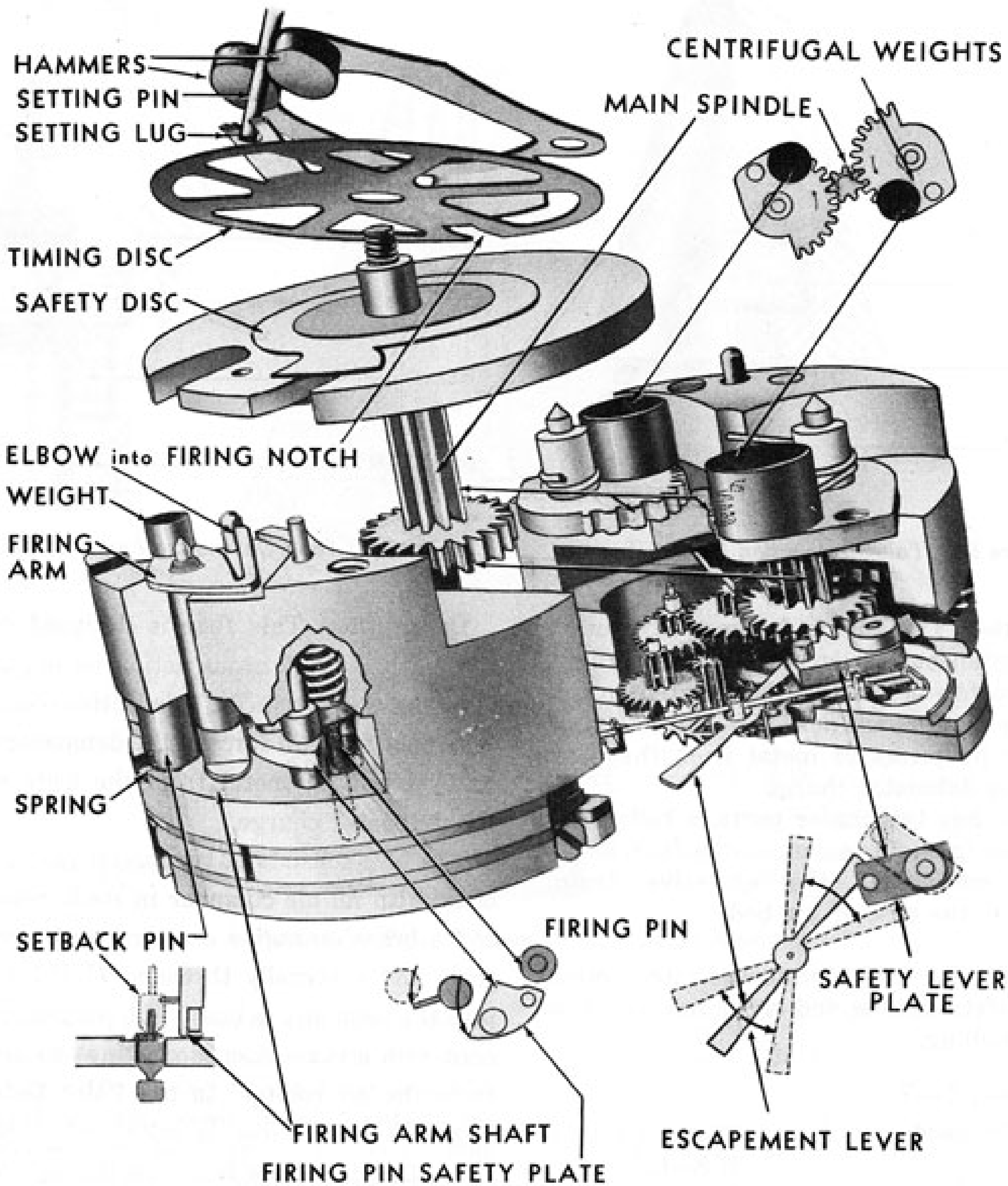


Figure 89. Centrifugal Timing Mechanism

NOSE TIME FUZES FOR PROJECTILES

Mk 18 Mods 0—4 (Obsolescent)

Projectiles used in
- 4"/50 Illuminating
- 5"/25/38/51 A.A. Common
- 5"/25/38/51 Illuminating
- 5"/38 Window
- 5"/38 W. P.
- 5"/51 H. C.
- 6"/47/50/53 Illuminating
- 6"/47/53 H.C.
- 8"/55 H.C.

Over-all length, inches................3.54
Diameter at base of ogive, inches......3.05
Threaded length, inch..................0.81
Threads ....7 R.H.
Weight, pounds........................2.52
Material ....Brass
Setting times, seconds
Mods 2, 3, and 4—minimum, 0.6
maximum, 45
Mods 0 and 1 —minimum, 2.4
maximum, 45

Description: In its assembled form, the fuze has a contour which corresponds to that of the Navy medium- and major-caliber projectiles. It consists of four main units, as follows:

1. Movement assembly—The movement assembly is attached to the inside of the body by three holding screws.

2. Body—The brass body contains the magazine charge, 30 grains of black powder, and the bottom closing screw assembly. It is threaded to fit an adapter, which, in turn, is threaded into the nose of the projectile.

3. Lower cap assembly—The brass lower cap, or graduated rotative cap, is attached to the body by a joint, consisting of a steel wire leading through grooves in the cap and body. This allows rotative motion between the lower cap and the body, but prevents axial motion between the lower cap and the body. It has a tensioning feature wherein the torsional resistance which restrains rotative motion is adjusted by four screws during assembly of the fuze.

4. Upper cap—The brass upper cap screws into the lower cap and completes the nose contour of the assembled fuze.

For purposes of explanation, the movement assembly may be divided into three main parts, as follows:

1. The timing-disc mechanism consists of the timing disc, a setting pin, a spring hammer assembly, and the central drive shaft. The timing disc has a firing notch on one side and, on the other side, a forked setting lug which engages the setting pin located in the top inside shoulder of the lower, rotative, cap. The timing disc is secured to the central drive shaft by a friction clutch, so that it may be turned independently of the central drive shaft. Around the top of the timing disc is a retaining ring which prevents the timing disc from riding forward when the projectile initially seats itself in the gun, and also prevents the hammer from driving the setting lug down too far. Beneath the timing disc is a safety disc, the projection of which bears against the elbow piece of the firing arm. This part is rigidly secured to the central shaft, so that it will rotate out of the way when the clock operates. Its purpose is to provide a safe and a minimum setting.

In setting the clock, the lower cap is rotated to turn the setting pin, which, in turn, will rotate the timing disc to the desired position, since the setting pin is engaged by the setting lug of the timing disc. Disengagement of these two parts is effected by the spring hammer assembly, which is fastened on one end to the top inside shoulder of the lower cap and (on the opposite end) has two small weights.

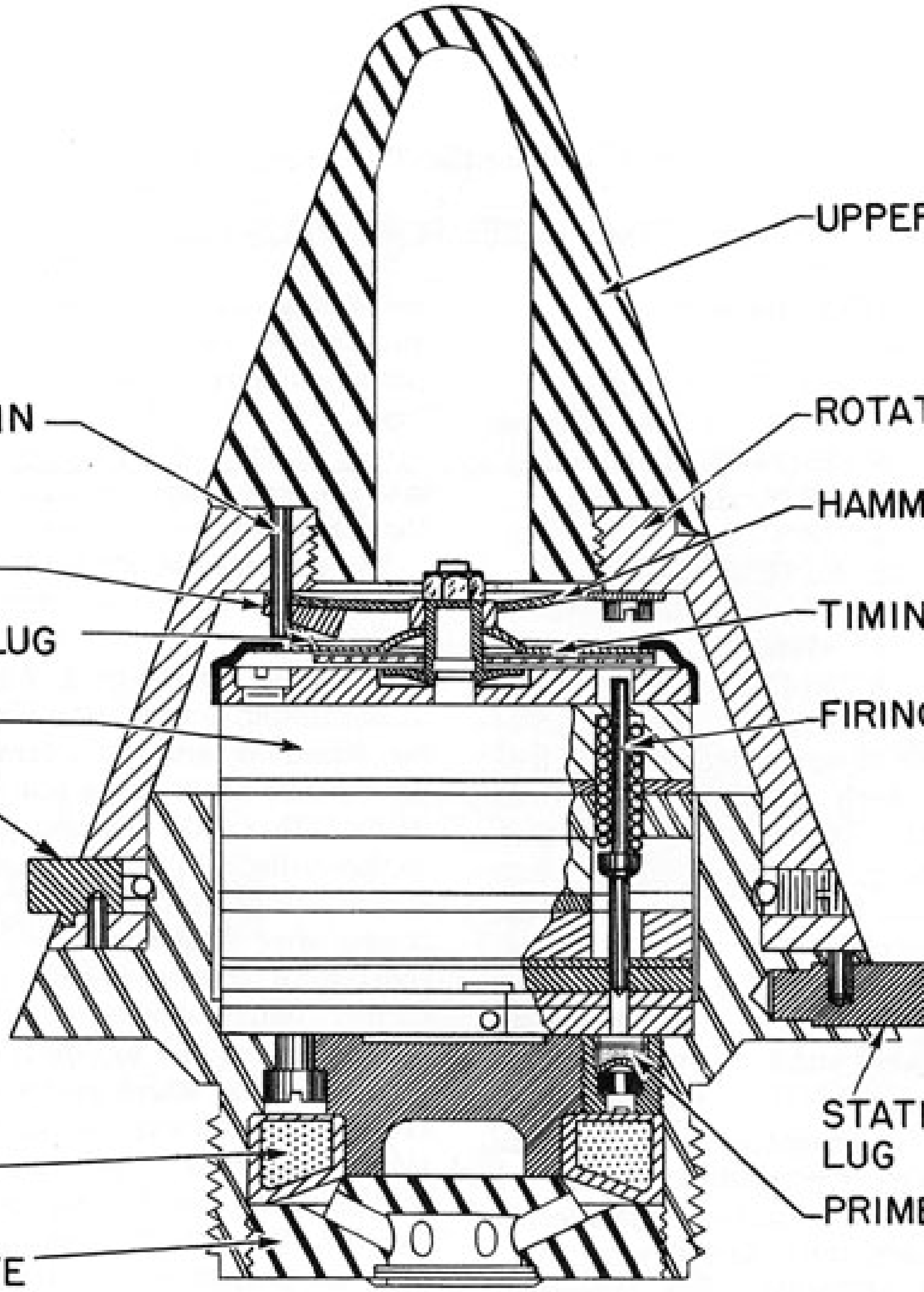


Figure 90. Nose Time Fuze Mk 18

2. THE CLOCK MECHANISM consists of two centrifugal gear arcs, a series of reduction gears, and the escapement mechanism. The centrifugal gear arcs are geared to the central drive shaft and are weighted on one side so that they will turn in a counterclockwise direction, thus turning the central shaft and the timing disc in a clockwise direction. The gear arcs have starter springs on them which serve to prevent the gears from freezing. The reduction gears are similarly geared to the central spindle, and their rotation is governed by the escapement mechanism which is connected to the lowest gear. The escapement mechanism consists of an escapement gear, escapement lever, escapement-lever spring, safety-lever plate, and safety lever plate spring. In the assembled position, the escapement lever is prevented from moving by the safety-lever plate, which has a pin protruding from the bottom of it and engages the escapement lever. The safety-lever plate is pivoted with a weight on one end, and

is held in position by the safety-lever plate spring. The escapement lever acts as a balance wheel and is caused to move back and forth by the escapement-lever spring, which is a hair spring secured at both ends and attached to the escapement lever.

3. THE FIRING MECHANISM consists of the firing arm, firing-arm shaft, set-back pin, firing-pin safety plate, and firing pin. The firing arm is pivoted and has a weight on one end and, on the opposite end, an elbow piece which bears against the outer periphery of the timing disc. Rigidly secured to the firing arm is the firing-arm shaft, which is prevented from turning in the assembled condition by the set-back pin. The set-back pin is held in position by the set-back pin spring and rests in front of a projection of the firing-arm shaft, thus preventing the latter piece from rotating. In the bottom of the firing-arm shaft is a notch. Bearing against the shaft in such a position that it will pass through the notch when the shaft is rotated, is the firing-pin safety plate. This safety plate is also pivoted and is fitting under a shoulder of the cocked firing pin, thus holding it away from the primer beneath it.

Operation: The fuze is armed by set-back, driven by centrifugal force governed by an escapement mechanism, and fired by a spring-driven firing-pin. When the projectile is fired from the gun, the force of set-back accomplishes two things:

1. The set-back pin overcomes its spring and drops into the bottom of the fuze. This action frees the firing-arm shaft for later rotation.

2. The hammer spring assembly pivots down the weights on one end to strike the setting lug, thus depressing it and freeing it from the setting pin. When the force of creep sets in, the spring returns the weights to their original position, in front of the timing disc.

As the projectile rotates, centrifugal force accomplishes four things:

1. The safety-lever plate of the escapement mechanism is pivoted out of the way, thus releasing the escapement lever and unlocking the escapement mechanism. This initial movement causes the escapement lever to oscillate, thus acting as the balance wheel and governing the speed of operation.

2. As soon as the escapement mechanism has been unlocked, the weights on the centrifugal gear arcs tend to move outward, thus causing the arcs to pivot and rotate the central shaft and, consequently, the timing disc. This rotation is slowed down by the series of reduction gears, and its speed is determined by the escapement mechanism. This rotary motion of the timing disc turns the firing notch around to the elbow piece of the firing arm.

3. When the firing notch has been presented to the elbow piece of the firing arm, the weight on the opposite end of the firing arm is moved outward, turning the elbow into the slot and turning the firing-arm shaft. This is now possible, since the set-back pin was depressed when the projectile was initially fired.

4. As the firing-arm shaft rotates, the notch in the bottom of it is presented to the firing pin safety plate, which will pivot through this notch, thus moving out from under the shoulder of the firing pin. The firing pin will then be thrown downward onto the primer by its compressed spring. The primer will then ignite the black powder charge in the base of the fuze.

Remarks: Mods 2, 3, and 4 are identical, but made by different manufacturers.

Mk 22 Mods 0—6 (Obsolescent)

Projectiles used in 3″/23/50 A.A. and Ill. 4″/50 H.C.

Over-all length, inches....................4.55
Diameter at base of ogive, inches........2.4
Threaded length, inch.....................0.81
Threads ....7 R.H.
Material.......Upper body—zinc/lead alloy
Center body—brass
Base—aluminum

Setting times, seconds
Mods 0–3—minimum, 1.4
maximum, 30
Mods 4–6—minimum, 0.6
maximum, 30

Description: The mechanism for this fuze is very similar to that described for the Nose

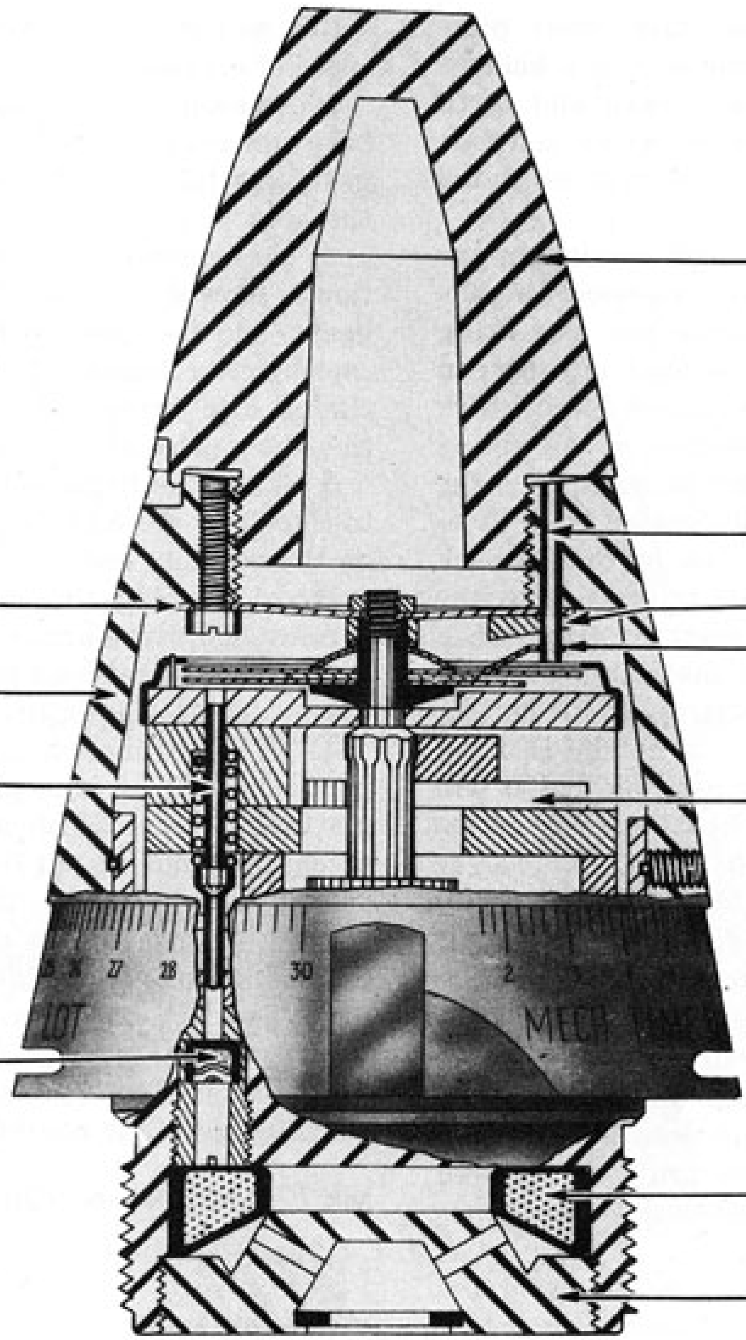


Figure 91. Nose Time Fuze Mk 22

Time Fuze Mk 18. In the Mk 22, however, the centrifugal weights do not have "kick-off" springs, and the Mk 22 is slot-set instead of lug-set, as the Mk 18. Also, the Mk 22 is very similar to the Army M43A3.

Mods 4, 5, and 6 are identical, but are made by different manufacturers.

Mk 25 Mods 0—3

Projectiles used in.......5"/54 H.C. and Ill
6"/47 (D.P.) H.C.

Over-all length, inches................4.55
Diameter at base of ogive, inches......2.40
Threaded length, inch.................0.81
Threads ....7 R.H.
Material...... Nose—die-cast lead-zinc alloy
Body—brass
Base—aluminum
Setting times, seconds........minimum, 0.6
maximum, 45

Description: The Nose Time Fuze Mk 25 is a combination of the Nose Time Fuzes Mk 50 and

Mk 51. It has the shape of the 30-second Nose Time Fuze Mk 51, but contains the 45-second clockwork of the Mk 50. The longer, slimmer shape of the Mk 51 is necessary because of the more streamlined shape of the 5"/54 and 6"/47 D.P. projectiles with which it is assembled. But, since these projectiles are used in long-range guns, they need the 45-second clockwork.

The description of the clockwork in the Nose Time Fuze Mk 18 is equally applicable to the Mk 25.

This fuze has slots cut for the setting mechanism, like the slots on the Mk 22 or Mk 50.

The Mk 25 is a moisture-resistant design, having gaskets placed between the upper and lower caps and between the lower cap and the body, and a silica gel unit in the base cavity to absorb what moisture penetrates the gaskets. This moisture resistance prevents deterioration of the metal parts and the explosive.

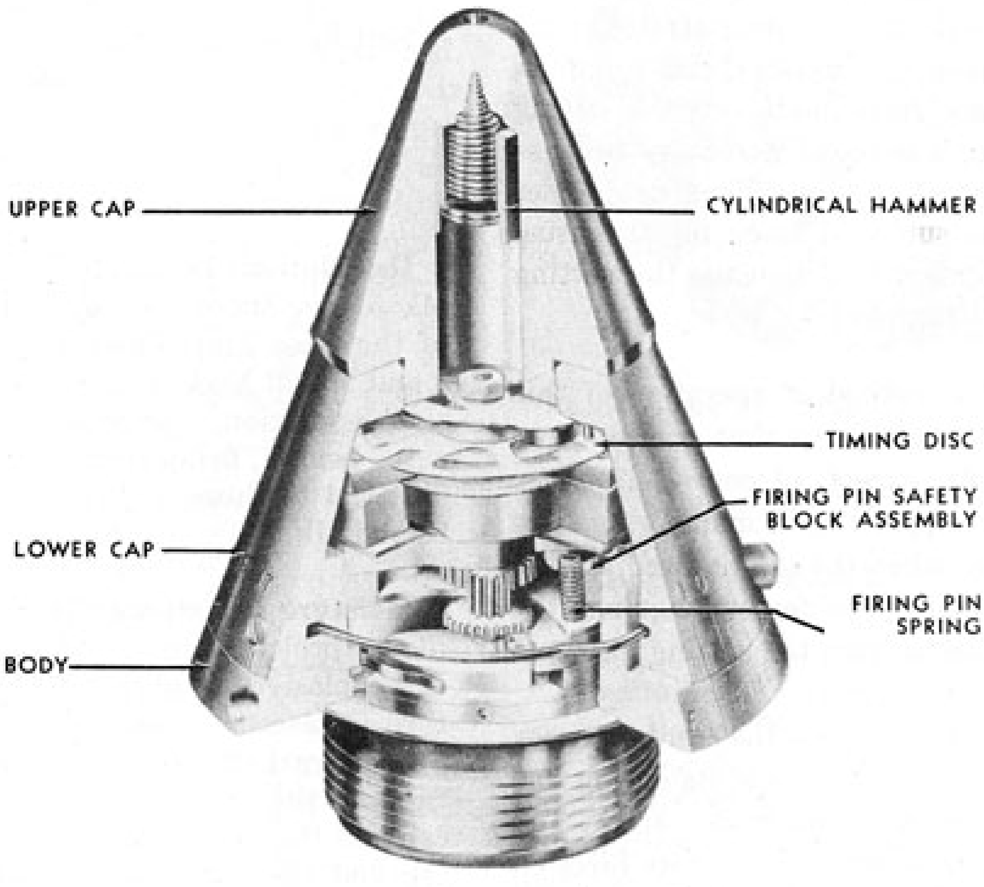


Figure 92. Nose Time Fuze Mk 42

Mk 42 (Obsolete)

Projectiles used in	12"/50 H.C. 14"/45/50 H.C. 16"/45/50 H.C.
Over-all length, inches	3.54
Diameter at base of ogive, inches	3.05
Threaded length, inch	0.81
Threads	7 R.H.
Weight, pounds	2.5
Material	Brass
Setting times, seconds	Minimum, 0.6 Maximum, 45

Description: The Nose Time Fuze Mk 42 was developed to supersede the Mk 18 when used in major-caliber H.C. projectiles, because of the erratic performance of the latter fuze when so employed. The fuze is generally similar to the

Nose Time Fuze Mk 61, differing only in that the primary driving force of the Mk 42 is provided by a heavy mainspring instead of by centrifugal weights. The driving force for the clockwork mechanism thus becomes substantially independent of the rate of spin of the projectile, and is applied during the entire running time of the fuze.

In addition to the spring-driven feature, the Nose Time Fuze Mk 42 also differs from the Mk 61 in that a heavy additional hammer is located in the recess in the nose cap of the fuze. This hammer is attached to the nose cap by a spring. On set-back, this hammer stretches the spring and strikes the conventional hammer, giving it additional force in striking the setting lug. This feature was found necessary because the low set-back of major-caliber projectiles failed to provide sufficient force for the usual hammer arrangement to disengage the setting lug from the setting pin.

Operation: The method of operation of this fuze is generally similar to that of the Nose Time Fuze Mk 61, except, of course, that the driving force is supplied by a mainspring. The force of set-back, when the gun is fired, causes the auxiliary hammer to descend against the main hammer, disengaging the setting lug from the setting pin.

Centrifugal force causes the center arbor detent to move outwards against its spring and out of engagement with the center arbor. The mainspring is then allowed to exert its force on the center arbor, actuating the escapement-controlled clockwork mechanism. All other features of operation are identical to those of the Nose Time Fuze Mk 61.

Remarks: This fuze is now considered obsolete. It was found during functioning trials that the auxiliary hammer did not function properly on set-back. The Nose Time Fuze Mk 62 is designed to supersede this fuze in major-caliber H.C. projectiles.

Mk 50 and Mk 51

Projectiles used in

Mk 50

4"/50 Illuminating
4"/25/38/51 A.A. Common
5"/25/38/51 Ill.
5"/38 Window
5"/38 W.P.
5"/51 H.C.
6"/47/53 H.C. and Ill.
8"/55 H.C.

Mk 51

3"/23/50 A.A. and Ill.
4"/50 H.C.

Setting times, seconds

Mk 50—minimum, 0.6
maximum, 45
Mk 51—minimum, 0.6
maximum, 30

Description: The Nose Time Fuzes Mk 50 and Mk 51 are merely moisture-resistant versions of the Nose Time Fuzes Mk 18 Mods 2, 3, and 4 and Mk 22 Mods 4, 5, and 6, respectively. The size, operation, component parts (except as noted below), firing train, and setting times are identical to those of the Nose Time Fuzes Mk 18 and Mk 22.

Moisture Resistance: The following developments prolong the life of the mechanism and the explosive. A silica gel bag to absorb moisture is placed in the base cavity of the fuze. Special gaskets are placed between the upper cap and the lower cap, and between the lower cap and the body. The joint between the upper cap and the lower cap is coated with bakelite varnish. The primer unit ends are covered with bakelite varnish. Thread luting compound is applied to the joint between the body and the bottom closing screw. The brass disc at the center of the bottom closing screw is crimped in under a washer and then coated with bakelite varnish. All screw heads visible on the outside are coated with glyptol lacquer.

Remarks: Different modifications of these fuzes indicate nothing more than different manufacturers.

Mk 57

Projectiles used in......8"/55 H.C. (for use in 8" Rapid-Fire case gun).
Over-all length, inches................4.305
Diameter at base of ogive, inches......2.983
Threaded length, inch.................0.47
Threads ....7 R.H.
Material ....Brass
Setting times, seconds.... minimum, 0.8–1.0
maximum, 45

Description: This fuze is identical to the Nose Time Fuze Mk 61 in so far as the internal mechanism and method of operation are concerned. The fuze differs from the Mk 61 in that it is provided with external slots for setting, rather than setting lugs. Furthermore, the external contour of the fuze differs considerably from that of the Nose Time Fuze Mk 61. The contour changes were necessary to allow the fuze to continue the more streamline shape of the 8-inch H.C. projectile and to strengthen the fuze body and lower cap sufficiently to accommodate the setting slots.

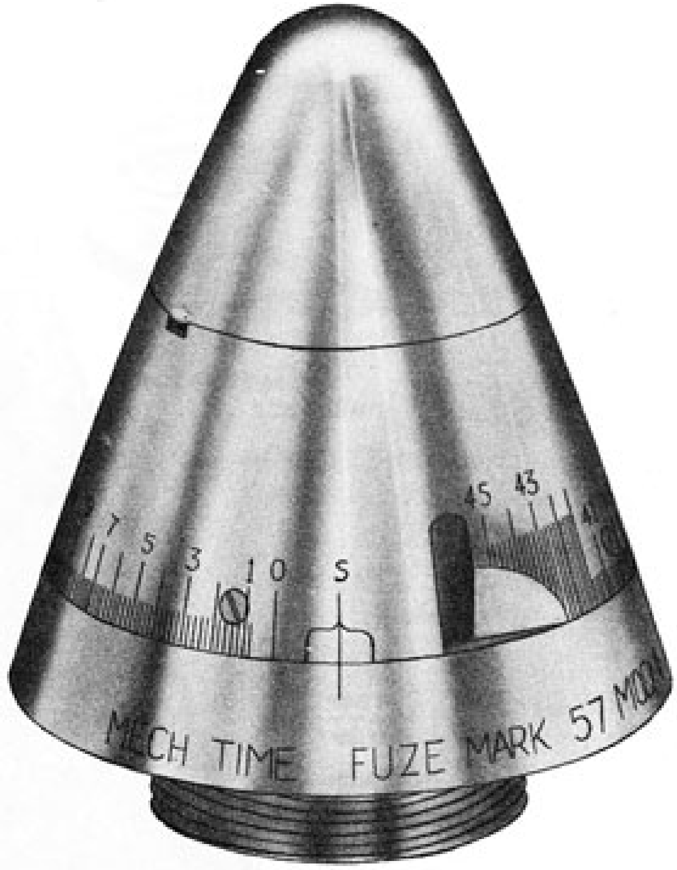


Figure 93. Nose Time Fuze Mk 57

Mk 61, Mk 62, Mk 63

Projectiles used in

Mk 61 5"/38 A.A. Com.
5"/38 W.P.

Mk 62 12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

Mk 63 4"/50 Ill.
5"/25/38/51 A.A. Com.
5"/25/38/51 Ill.
5"/38 W.P.
5"/38 Window
5"/51 H.C.
6"/47/53 H.C.
6"/47/53 Ill.
8"/55 H.C.

Over-all length, inches................3.54
Diameter at base of ogive, inches.......3.05
Threaded length, inch.................0.81
Threads ....7 R.H.
Weight, pounds.......................2.52
Material ....Brass
Setting times, seconds.... minimum, 0.9–1.0
maximum, 45

Description: The Nose Time Fuze Mk 61 is a modification of the mechanical time fuzes of the Mk 18 and Mk 50 type, designed specifically for the 5"/38 projectile when the special reduced charge with initial velocity of 1,200 feet per second is employed. The modifications, allowing the fuze to function at lower rotational velocities and decreased set-back, are as follows:

A weaker hammer spring is used.

The set-back pin has been eliminated.

A centrifugally operated firing-pin safety block has been added under the firing pin.

A centrifugally operated detent or plate, retained by a flat spring, holds the safety-lever plate, which locks the escapement mechanism.

Heavier centrifugal weights are placed on the driving gears to drive the clockwork movement.

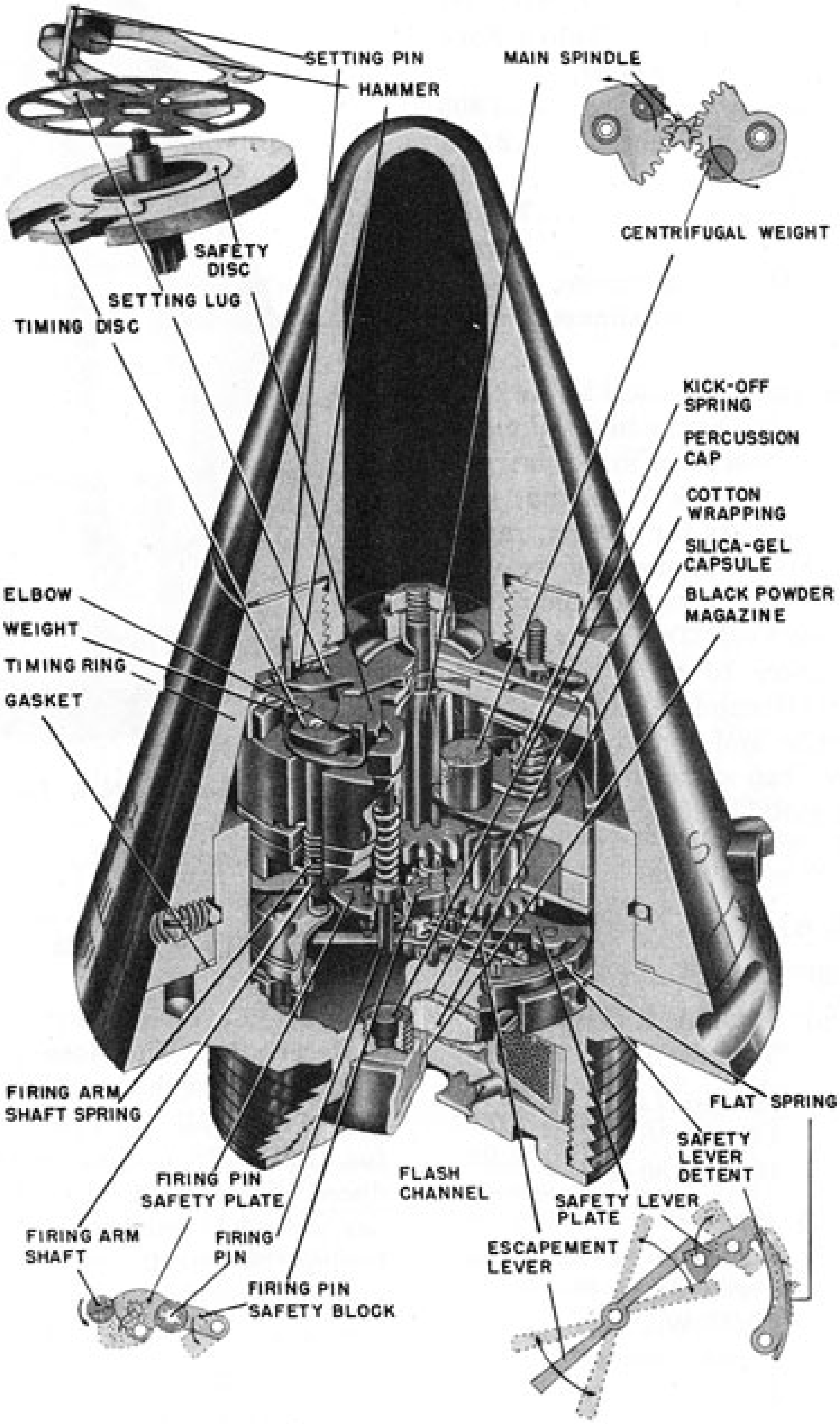


Figure 94. Nose Time Fuse Mk 61

Stronger centrifugal "kick-off" springs are incorporated on the centrifugal gears. These springs are actually driving springs, and exert a strong force throughout the entire cycle.

A spring is added to the firing-arm shaft.

Weight is added to the safety-lever plate.

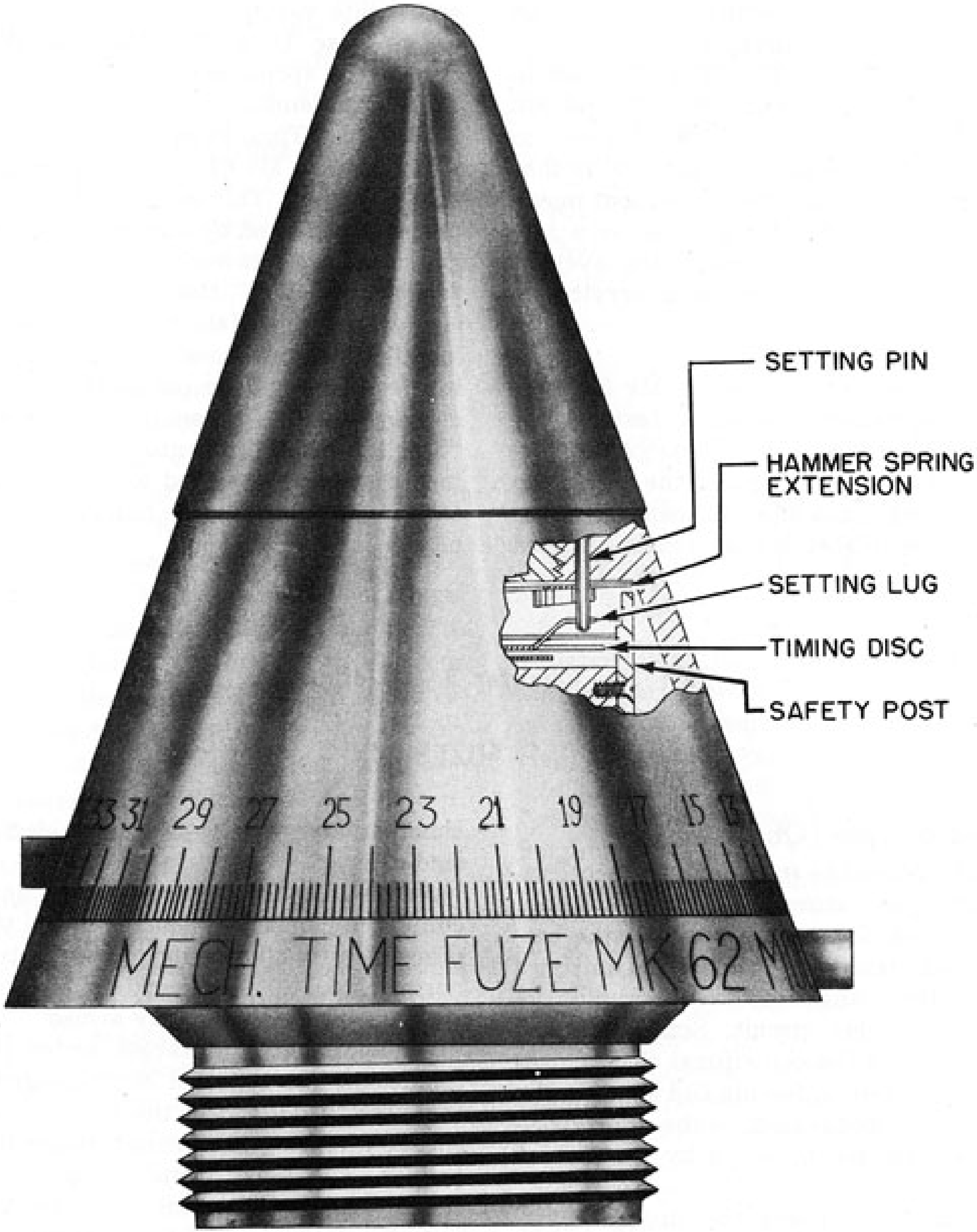


Figure 95. Nose Time Fuze Mk 62

The fuze body is slightly altered to provide clearance for the heavier driving weights.

The safety setting is changed to 0.9–1.0 second.

The Nose Time Fuze Mk 62 is almost identical to the Mk 61, but is slightly further modified to allow its use in the major-caliber H.C. projectiles, where extremely low set-back force on firing is encountered. The additional modifications incorporated in the Mk 62 are as follows:

A still weaker hammer spring is used.

A safety post is provided beneath the hammer spring, preventing arming of the fuze as the result of accidental dropping.

The Nose Time Fuze Mk 63 is designed to replace the Nose Time Fuzes Mk 18 and Mk 50 in all projectiles where the Mk 50 is now in use. Its internal construction is identical to that of the Mk 61, except that the escapement movement has been regulated for a higher spin rate —12,600 revolutions per minute—the average spin rate of the 5"/38 projectile at service velocities.

Remarks: These fuzes, like the Mk 50 type, have complete moisture-resistant features incorporated. These measures include gaskets between the time-setting ring and the upper cap and body assemblies, a silica-gel capsule in the base of the fuze to absorb excess moisture, and joints and openings coated with approved luting or bakelite varnish.

The Nose Time Fuze Mk 62 is designed to replace the spring-driven Nose Time Fuzes Mk 42 in all assemblies.

The Nose Time Fuze Mk 62 differs in operation from the Mk 61 only in the functioning of the safety post. This safety post consists merely of a stud fastened by a screw to the uppermost ring of the clockwork mechanism. With the fuze set on "Safe", this stud is located beneath a projecting end of the hammer spring, preventing the hammer from disengaging the setting lug from the setting pin as the result of accidental dropping. When the fuze is set off the "Safe" position preparatory to firing, the hammer assembly is moved away from above the safety post, allowing the hammer to move down on set-back.

Part I — Chapter 3 — Section 4

V.T. FUZES

Mks 32 and 40 Type (Obsolete)

Operation: When the round is fired, acceleration in the gun causes the three set-back switches to close. This action connects the battery to the electrical mechanism and initiates charging of the firing condenser throught its high-resistance delay circuit. Simultaneously, the set-back pin in the centrifugal clock moves back against its spring, freeing and starting the clock escapement mechanism. In the armed position, the set-back pin is locked by the locking spring.

Centrifugal force drives the clock through its permanent setting of 0.4 to 0.6 second, at which time the tripping lever moves over the spring-loaded arming pin. The arming pin moves forward, withdrawing from the interrupter cavity. This allows the interrupter pin to be moved outward by centrifugal force, thereby clearing the flash channel between the electric primer and the auxiliary detonating fuze, hitting the short-circuit plug, and breaking the short-circuit wire away from the electric primer leads.

Meanwhile, the firing condenser has been accumulating an electric charge. When this charge is sufficient to allow firing of the electric primer, normally 0.6 to 0.8 second in the dry-battery type fuze, the fuze is fully armed.

On approach to a target under the proper conditions, the reflected electromagnetic signal from the target causes the V.T. element to discharge the firing condenser through the electric primer. The blast from the primer operates the auxiliary detonating fuze, which in turn initiates detonation of the projectile.

Operation of the wet-energized fuzes of this type is identical, except that the electrolyte vial in the reserve energizer is broken by acceleration of the round, and centrifugal force distributes the electrolyte throughout the energizer. Charging of the firing condenser is not begun when the set-back switches close, but must wait until the electrolyte is uniformly

distributed through the reserve energizer. This normally occurs 0.2 to 0.3 seconds after set-back, thereby delaying complete arming of the unit until 0.8 to 1.1 seconds after set-back.

Mks 45, 47, 53, 58, and 59 Type

Operation: When the round is fired, acceleration in the gun barrel causes the fingers of the crown breaker to open up, allowing the electrolyte vial to break against the bottom of the breaker. Centrifugal force distributes the electrolyte throughout the energizer, activating it in 0.2 to 0.3 second. Centrifugal force also opens the handling safety switch, which previously had been shorting out the firing condenser.

The firing condenser begins to accumulate a charge through its high-resistance electrical delay, and electrical energy is fed to the electric mechanism in the V.T. element. Centrifugal force causes the small globule of mercury in the mercury switch to move through a porous membrane into the lower chamber, thereby removing the electric short circuit across the primer leads. This requires from 0.2 to 0.9 seconds, depending on the fuze and the rate of rotation of the projectile. When the firing condenser has accumulated enough electrical energy to allow firing of the electric primer, 0.6 to 1.0 second, the fuze is fully armed.

Upon approach to a target under proper conditions, the reflected electromagnetic signal from the target causes the V.T. element to discharge the firing condenser through the electric primer. The blast from the primer functions the auxiliary detonating fuze, which, in turn, initiates the detonation of the projectile.

The V. T. Fuzes Mk 53, Mk 47, and Mk 59 are equipped with two mercury switches instead of the single switch incorporated in the Mk 45 and Mk 58. This feature is provided to insure additional safety; in all other respects, these five fuzes are mechanically identical.

The differences in these fuzes lie in dimensions and contour of the head, thread sizes, and electrical characteristics (for slower spin, less set-back, etc.).

Mk 32 Mods 0—20, Mod 30, and Mod 40 (Obsolete)

Projectiles used in	5″/38/25/51* A.A. Common
Over-all length, inches	12 (approx.)
Diameter at base of ogive, inches	3.3 (approx.)
Threaded length, inch	0.6 (approx.)
Threads	6 R.H.
Material	Steel base rings, black plastic nose ogive, aluminum nose cap or button tip
Weight, pounds	6.81
Minimum range, yards	Mods 0–20, 40—600 Mod 30—1,000
Energizer	Mods 0–20, 40—Dry Mod 30—Wet
Wave-suppression feature	Mod 40 only
Self-destructive feature	None

Description: This fuze was designed to initiate detonation when passing within the maximum influence radius of about sixty feet. The Mod 40 has reduced sensitivity against low-flying aircraft because of the wave-suppression feature (for values, see V.T. Fuze Mk 40). Burst heights above water for all Mods without the wave suppression feature will be high at most ranges, averaging 130 feet at 12,200 yards in the 5″/38 projectile, with burst heights varying widely between rounds. Burst heights over water will average lower at shorter ranges, but a wide dispersion in heights will occur. These fuzes are especially affected by water surface conditions. Burst heights of the Mod 40 above water (WSF) will vary between 10 and 50 feet.

Random premature bursts of rounds assembled with this fuze will occur along the trajectory after the fuze is armed but before it approaches a target. With targets at long range, 20 per cent of the rounds may burst before approaching the target, and a somewhat smaller percentage of prematures will occur at shorter ranges. If a target at long range is approached

*Mods 0–20 and 40 of this fuze can be used in the 5″/51 gun at 2600 ft./sec., I.V. reduced charge only. Mod 30 cannot be used in the 5″/51 rounds.

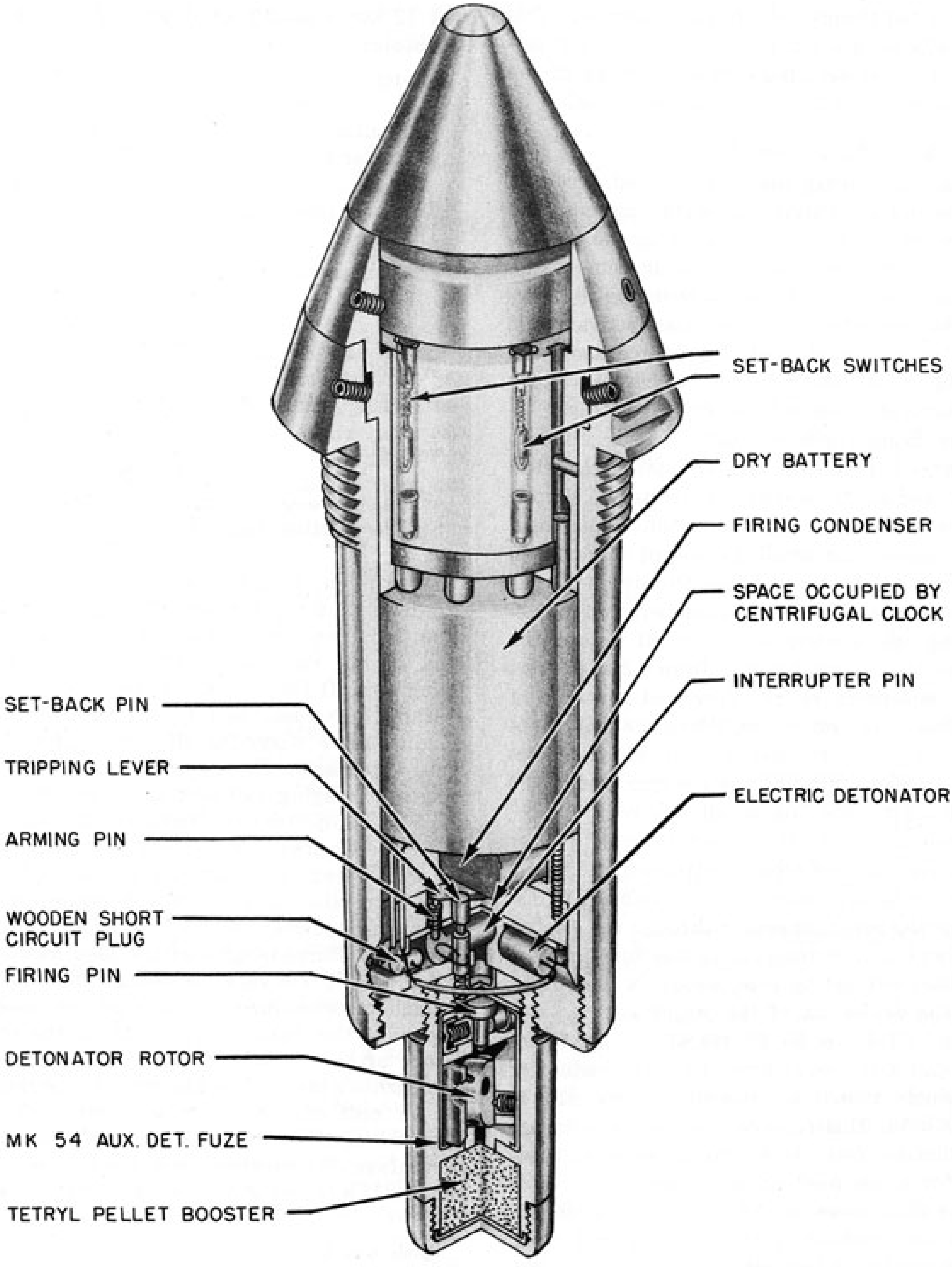


Figure 96. V.T. Fuze Mks 32 and 40 Type

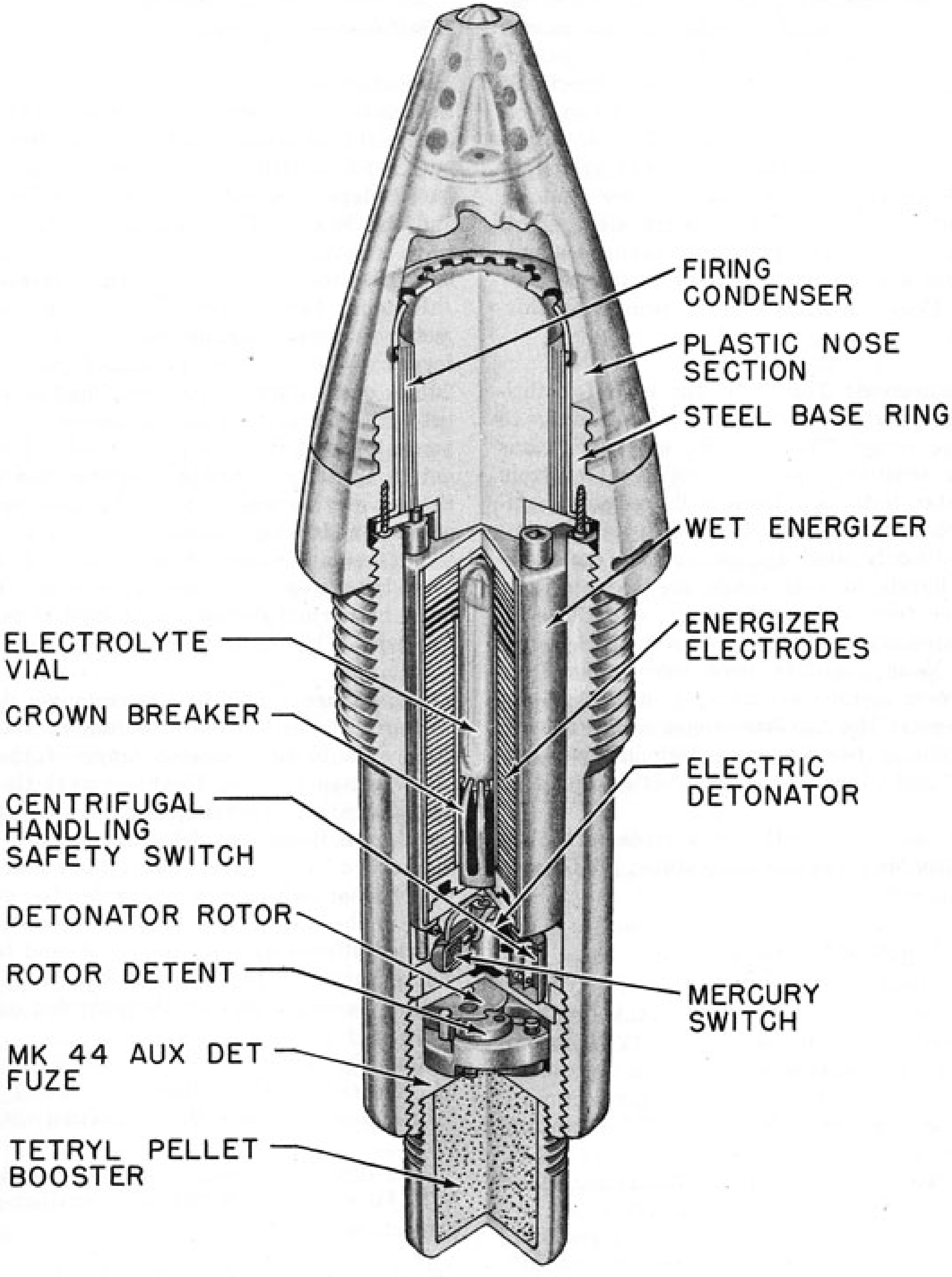


Figure 96A. V.T. Fuze Mk 45 (and above) Type

within the sensitivity limits of the fuze, 65 per cent of the rounds should function at the most critical point to throw fragments against the target. The percentage of proper functions at shorter ranges is higher by the amount of decrease in premature functions. The remainder of the rounds will be duds. Because of ageing of the dry energizer, only about 50 per cent of the rounds will function properly after eight months. The dry energizers are changed about every six months by Bureau of Ordnance personnel. Production has been suspended on this item.

Employment: This fuze was used for antiaircraft work from 600 yards minimum range to extreme range. The Mod 40, with WSF, has normal sensitivity above about 200 feet from the water, but has automatically reduced sensitivity below this level. Mods 0–20 and 30 are not ordinarily used against surface craft, because bursts at long range are too high for effective fragmentation damage, and those on low trajectory have a large dispersion in range. These Mods might be used with reduced effectiveness against low-flying planes.

Remarks: The Auxiliary Detonating Fuze Mk 54, replacing the Auxiliary Detonating Fuzes Mks 17 and 46, is used in conjunction with this fuze.

This fuze is currently being replaced by the V.T. Fuze Mk 53 in new projectiles; Mk 53 cavity is smaller.

Mk 40 (Obsolete)

Projectiles used in . . . . 5"/25/38 A.A. Common
Over-all length, inches . . . . 12 (approx.)
Diameter at base of ogive, inches 3.3 (approx.)
Threaded length, inch . . . . 0.5 (approx.)
Threads . . . . 6 R.H.
Material . . . . Steel base, black plastic ogive; may have button tip.
Weight, pounds 6.81
Minimum range, yards 800
Energizer . . . . Wet
Wave-suppression feature . . . . Present
Self-destructive feature . . . . None

Description: This fuze initiates detonation if the trajectory passes within the maximum influence radius of seventy feet. Against aircraft below 200-foot altitude, operating radius is reduced, depending on the altitude of the plane and the height of the waves, because of the wave-suppression feature. Burst height over land or water may vary between 10 and 30 feet.

Random bursts will occur along the trajectory after arming, but before approaching a target. With a target at 12,200 yard range, 20 per cent of the rounds will function prematurely; and at closer ranges a somewhat smaller percentage will function prematurely. If the target at 12,200-yard range is approached within the sensitivity limits of the fuze, 65 per cent of the rounds will function.

These units have wet energizers of the reserve type; so effectiveness is not greatly diminished by normal storage for at least 18 months. Production has been suspended on this item.

Employment: This fuze is recommended for antiaircraft work from a minimum range of 800 yards to the extreme range of the gun. The wave-suppression feature makes this fuze useful against low-flying aircraft and surface targets, as it will not detonate on water influence above 15 to 20 feet; but it must pass somewhat closer to the target in order to function than in the case of high-flying targets. It may be used effectively for barrage of land targets where bursts at 10 to 30 feet will be effective against personnel and lightly protected installations.

Remarks: The Auxiliary Detonating Fuze Mk 54, replacing the Auxiliary Detonating Fuzes Mks 17 and 46, is used in conjunction with this fuze.

This fuze is currently being replaced by the V.T. Fuze Mk 53 in the new, smaller-cavity projectiles.

Mk 45 Mods 11 and 12 (Obsolete)

Projectiles used in . . . . 3"/50 A.A.
Over-all length, inches . . . . 7.7 (approx.)

Diameter at base of ogive, inches
2.4 (approx.)
Threaded length, inch........1.0 (approx.)
Threads ....12 R.H.
Material.............Plastic ogive molded integral to steel base; perforated nose cap molded into forward end of plastic ogive
Weight, pounds 2.40
Minimum range, yards................600
Energizer ....Wet
Centrifugal handling safety switch..Present

Description: This fuze initiates detonation within the maximum influence radius of fifty feet. Burst heights over water at long range will average around 75 feet, with wide variations in burst height occuring as a result of wave effect and variations in sensitivity between rounds. Burst heights over water at shorter ranges will generally average to lower levels.

Random bursts will occur along the trajectory after arming; so that approximately 30 per cent of the rounds will have burst prematurely before approach to a target at extremely long range. At long range, after 30 per cent of the rounds have functioned prematurely, 50 per cent of the rounds will function when passing the target within the sensitivity limits of the fuze.

These fuzes have wet energizers of the reserve type.

Employment: This fuze is used for antiaircraft work from a minimum range of 600 yards to the extreme range of the gun. The V.T. Fuze Mk 45 is useful for low-level attack against torpedo bombers or surface craft, if it is realized that the fuze functions on approach to water as outlined above. The fuze is less sensitive at shorter ranges.

Remarks: The original V.T. Fuze Mk 45 Mod 11, with longer stem, has been declared unserviceable and recalled, to be replaced by the Mod 12.

The V.T. Fuze Mk 45 Mod 12 is currently being replaced by the V.T. Fuze Mk 58.

The Auxiliary Detonating Fuze Mk 44 is used in conjunction with these fuzes.

Mk 47 Mod 0

Projectiles used in..............6"/47 H.C.
Over-all length, inches........8.9 (approx.)
Diameter at base of ogive, inches
3.3 (approx.)
Threaded length, inch..................0.5
Threads ....6 R.H.
Material..............Plastic ogive molded integral with steel base ring, and steel nose cap molded inside of forward end of plastic ogive
Weight, pounds......................4.28
Minimum range, yards.................800
Energizer ....Wet
Wave-suppression feature..........Present
Self-destructive feature ....None
Centrifugal handling safety switch..Present

Description: This fuze is designed for the H.C. round of the 6"/47 dual-purpose gun. It is expected that its sensitivity against aircraft will be of the same order as that of the V.T. Fuze Mk 53. The Auxiliary Detonating Fuze Mk 44 is used with this fuze.

Mk 53 Mods 0—6

Projectiles used in............5"/25/38/51
A.A. Common
Over-all length, inches........8.9 (approx.)
Diameter at base of ogive, inches
3.3 (approx.)
Threaded length, inch.........0.5 (approx.)
Threads ....6 R.H.
Material............Steel base with integral molded plastic nose; some Mods may have steel insert molded in forward end of plastic nose
Weight, pounds 4.28
Minimum range, yards
Mods 0–2—700
Mods 3 and later—500
Energizer ....Wet

Wave-suppression feature..........Present
Self-destructive feature.............. None

Description: This fuze functions within a maximum influence radius of about eighty feet. Sensitivity to aircraft below 200-foot altitude will be somewhat less, depending on the altitude of the plane and the height of the waves, because of the wave-suppression feature. Burst heights above water will vary between 10 and 30 feet.

Random bursts along the trajectory will occur after arming, but before reaching a target. At 12,200-yard range on test firing, approximately ten per cent of the rounds will function prematurely. Upon approaching a target within the sensitivity limits of the fuze at 12,200-yard range, 80 per cent of the rounds will function at the most advantageous point for enveloping the target with fragments. The percentage of normal functioning at shorter ranges will be higher by the amount of decrease of premature bursts. The remainder of the rounds will be duds.

These fuzes have wet energizers of the reserve type.

Employment: This fuze is used for antiaircraft work from a minimum range, as shown above, to the maximum range of the gun at all elevations. It is useful against low-flying aircraft and surface craft where aerial-burst fuze action is desired. It is also effective for barrage work against personnel, light equipment, and land targets. Later Mods may have self-destructive action to initiate detonation at around 10,000 yards to protect outlying friendly ships and troops on the beach.

Remarks: This fuze is replacing the V.T. Fuzes Mk 32 and Mk 40 in all assemblies of new ammunition. The Auxiliary Detonating Fuze Mk 44 is used.

Mods 1, 2, and 3 have been declared unserviceable. Mods 5 and 6 have additional water-resistance and are not interchangeable with the previous Mods.

Mk 58 Mod 0—5

Projectiles used in..............3"/50 A.A.
Over-all length, inches........8.5 (approx.)
Diameter at base of ogive, inches 2.4 (approx.)
Threaded length, inch.........1.0 (approx.)
Threads ....12 R.H.
Material..............Plastic ogive molded integral to steel base; steel cap molded in forward end of plastic ogive
Weight, pounds 1.98
Minimum range, yards.................500
Energizer ....Wet
Wave-suppression feature..........Present
Self-destructive element.........Mod 5 only
Centrifugal handling safety switch..Present

Description: The maximum influence radius varies between 40 and 100 feet for different lots and Mods. Sensitivity to aircraft flying below 200-ft altitude will be reduced by the wave-suppression feature. Burst heights over water will average between 5 and 15 feet.

Random bursts of rounds will occur along the trajectory after arming, so that approximately 20 per cent of the rounds will have functioned before reaching a target at long range. When fired at a target at long range, after 20 per cent of the rounds have burst prematurely, 65 per cent will function.

Employment: This fuze is used for antiaircraft work for ranges of 500 yards to the extreme range. It is useful against low-flying aircraft and surface craft, and in land barrage against personnel and light equipment.

Remarks: The Auxiliary Detonating Fuze Mk 44 is used with this V.T. Fuze.

The V.T. Fuze Mk 58 is currently replacing the Mk 45 Mod 12 in the 3"/50 assembly.

Mods 3, 4, and 5 have additional water-resistance and are not interchangeable with previous Mods.

Mod 5 will have a self-destructive switch to function at a range of 6,000 to 9,000 yards. The switch is not adjustable.

Mod 0 is now obsolete.

Mk 59 Mod 0

Projectiles used in	5"/54 H.C.
Over-all length, inches	1-13/16
Diameter at base of ogive, inches	2.71
Threaded length, inch	0.5
Threads	6 R.H.
Material	Capless plastic ogive molded integral with steel base
Weight, pounds	4.05
Minimum range, yards	500
Energizer	Wet
Wave-suppression feature	Present
Self-destructive element	None
Centrifugal handling safety switch	Present

Description: This fuze is designed for use in the H.C. round of the new 5"/54 guns. It is designed for antiaircraft work from a minimum range of 500 yards to the extreme range of the gun at all elevations. The Auxiliary Detonating Fuze Mk 44 Mod 0 is used.

Part I — Chapter 3 — Section 5

AUXILIARY DETONATING FUZES FOR PROJECTILES

Mk 17 Mods 0—13

Fuzes found with	Mk 18 Mods 2–4 Mk 22 and Mods 1–5 Mk 29 Mods 1–3 Mk 30 Mods 1–3
Over-all length, inches	2.5
Diameter, inches	1.38
Weight, grams	348
Threaded length, inch	0.96
Threads	10 L.H.
Material	Steel body, not painted
Arming speed, r.p.m.	3,000–4,500

Description: The fuze is composed of a one-piece body, with a booster cap and plug closing the ends. The body assembly consists of the firing-pin housing and rotor housing, both of which are contained in the sealing cup. In the middle of the closing plug is an obturating cup with a sealing disc between the plug and the firing-pin housing. The firing-pin housing contains a metal firing pin which is held in position by two firing-pin detents. Contained within the rotor housing are a rotor and two rotor detents. The rotor, which contains two lead counterweights and the detonator, is assembled in the housing with the axis of the detonator at an angle of about 55 degrees from the axis of the fuze. The line of centers of the lead counterweights is at an angle of about 35 degrees from the axis. The rotor is held in the unarmed position by the two rotor detents, the tapered ends of which engage in holes in the side of the rotor.

Operation: As the projectile is fired from the gun, centrifugal force moves the firing pin and rotor detents back against their springs. Then centrifugal force, acting upon the lead counterweights in the rotor, will cause the rotor to turn until the detonator assembly is in line with the booster lead-in and firing pin. In this position, the rotor is dynamically balanced, centrifugal force holding the two lead counterweights at a maximum radius from the axis of rotation of the fuze. When the nose fuze functions, the gas pressure from it forces the obturating cup down, shearing the sealing disc adjacent to the firing pin and driving the firing pin down into the primer-detonator assembly which fires the booster lead-in and the booster.

Remarks: This fuze is not designed to function by itself, but will function only by the gas pressure from a nose fuze.

Mods 0–6, representing different manufacturers, were originally assigned for use in 3-inch to 16-inch A.A., A.A. Common, and H.C. projectiles. Later assignments restricted their use to 3-inch to 6-inch projectiles. Mods 0 to 6 were then withdrawn from service and replaced

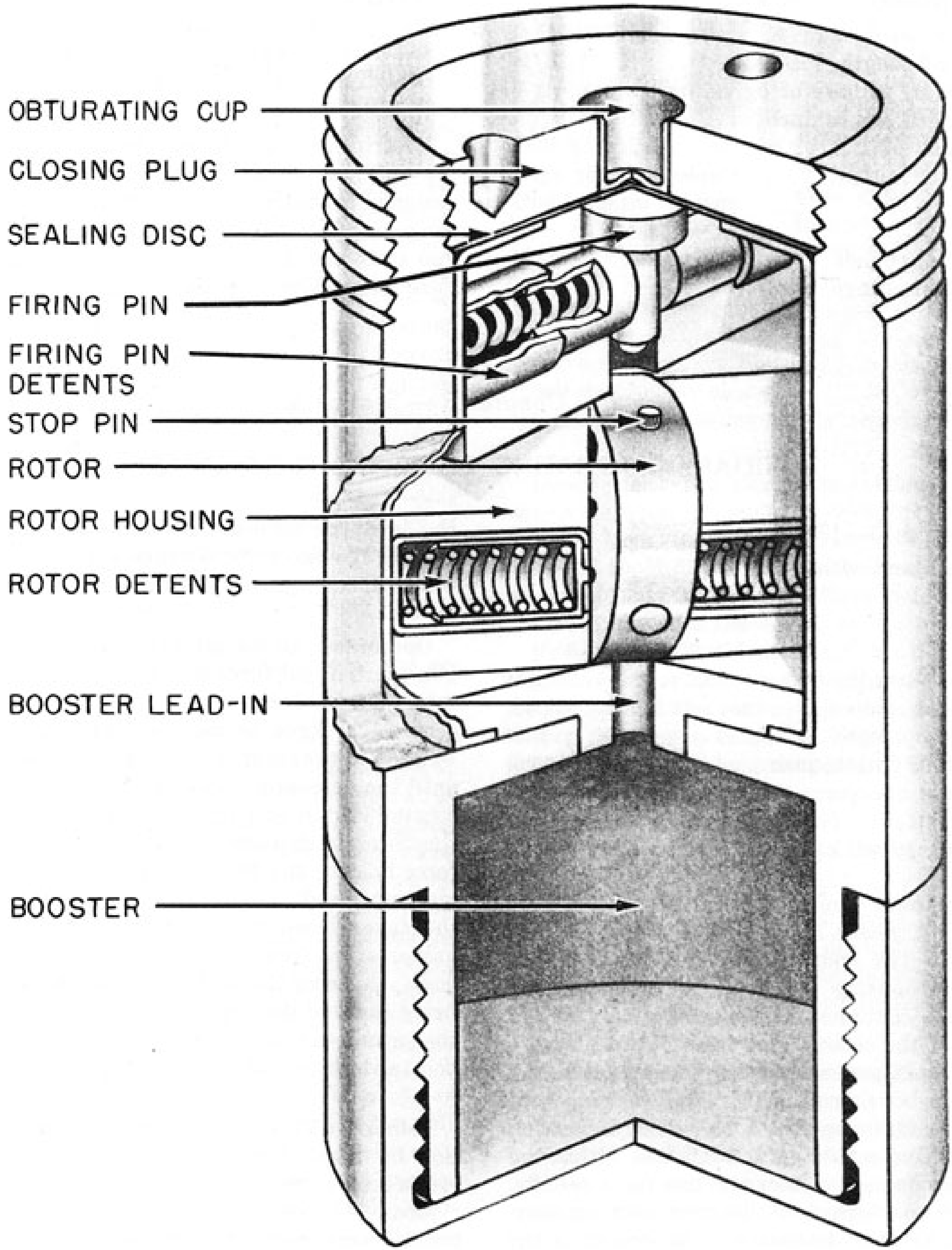


Figure 97. Auxiliary Detonating Fuze Mk 17 Mod 8

by Mods 8–13, later redesignated as the Auxiliary Detonating Fuze Mk 46. A special "green-stripe" Auxiliary Detonating Fuze Mk 17 Mod 8 with weaker detent springs was assigned to be

used in major-caliber H.C. ammunition. This fuze was later redesignated the Auxiliary Detonating Fuze Mk 35.

Mods 8–13 of Auxiliary Detonating Fuze Mk 46 differ from Mods 0–6 as follows:

1. To insure positive rotation, two additional lead counterweights were added to the rotor and two holes drilled in the rotor opposite these weights.
2. Two stop pins were added to the rotor, and two holes were cut in the rotor housing to engage the stop pins to prevent further rotation of the rotor after the detonator had become aligned with the firing pin.

Mk 17 Mods 0–11 are considered obsolete.

Mk 35 Mod 0 (Obsolete)

Fuzes found with..........Mk 29 Mods 1–3
Mk 39
Mk 48

This fuze is a redesignation of the Auxiliary Detonating Fuze Mk 17 Mod 8. See "Remarks" on Mk 17.

Mk 43 Mods 0 and 1

Fuzes found with.........Mk 25 and Mk 30
Over-all length, inches................3.18
Threaded length, inch................0.625
Threads ....11 L.H.

This fuze is like the Auxiliary Detonating Fuze Mk 17 Mods 8–13 (see "Remarks" on Mk 17), except for the dimensions listed above and the fact that it has a pointed firing pin and a lead azide detonator, also an adapter and an additional booster pellet. This extra booster is required because of the long, narrow nose of the 5"/54 and 6"/47 D.P. projectiles, in which this fuze is used.

Mod 0 differs from Mod 1 in that the former has the two-piece body as illustrated, and the latter has a one-piece specially-built body. The Mod 1 is the design which was produced in quantity.

Mk 44 Mods 1 and 2; also Mk 52

Projectiles used in
Mk 44 Mods 1–2....3"/50 A.A.
5"/25/38/51
A.A. Common
5"/54 H. C.
6"/47 H.C.
Mk 52 ....8"/55 H.C.
12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

Over-all length, inches
Rotor housing 1.5
Booster cup 1.25

Description: This fuze is constructed in two parts, a booster cup and a rotor housing into the base of which the booster cup is screwed. The rotor housing contains a double rotor assembly, one rotor located above the other. The upper rotor contains a primer detonator incorporating lead azide. The lower rotor contains a booster lead-in of tetryl. In the assembled position, each rotor is locked by two centrifugal detents so that the components of the firing train are out of alignment.

Operation: The fuze is armed by centrifugal force, which causes the two sets of rotor detents to move outward against their springs, unlocking the rotors. The weighted rotors are then revolved by centrifugal force, until their motion is arrested by the stop pins. At this time the firing train is fully aligned, with the detonator immediately above the booster lead-in, and the fuze is armed. When the nose fuze functions, the gas pressure thus generated forces through the weakened part of the closing disc and fires the detonator, which initiates the booster lead-in and the booster.

Remarks: The Auxiliary Detonating Fuze Mk 52 is completely identical to the Mk 44, except that the rotor detent springs have been considerably weakened, allowing arming at lower rotational velocities than the Mk 44. This alteration was necessitated by the fact that the Mk 52 is employed in the low-spin major-caliber H.C. projectiles.

The Auxiliary Detonating Fuze Mk 44 Mod 1 has a die-cast motor housing; Mod 2 has a hole in the cover plate.

Mk 46 Mod 0 (Obsolete)

The Auxiliary Detonating Fuze Mk 46 is a

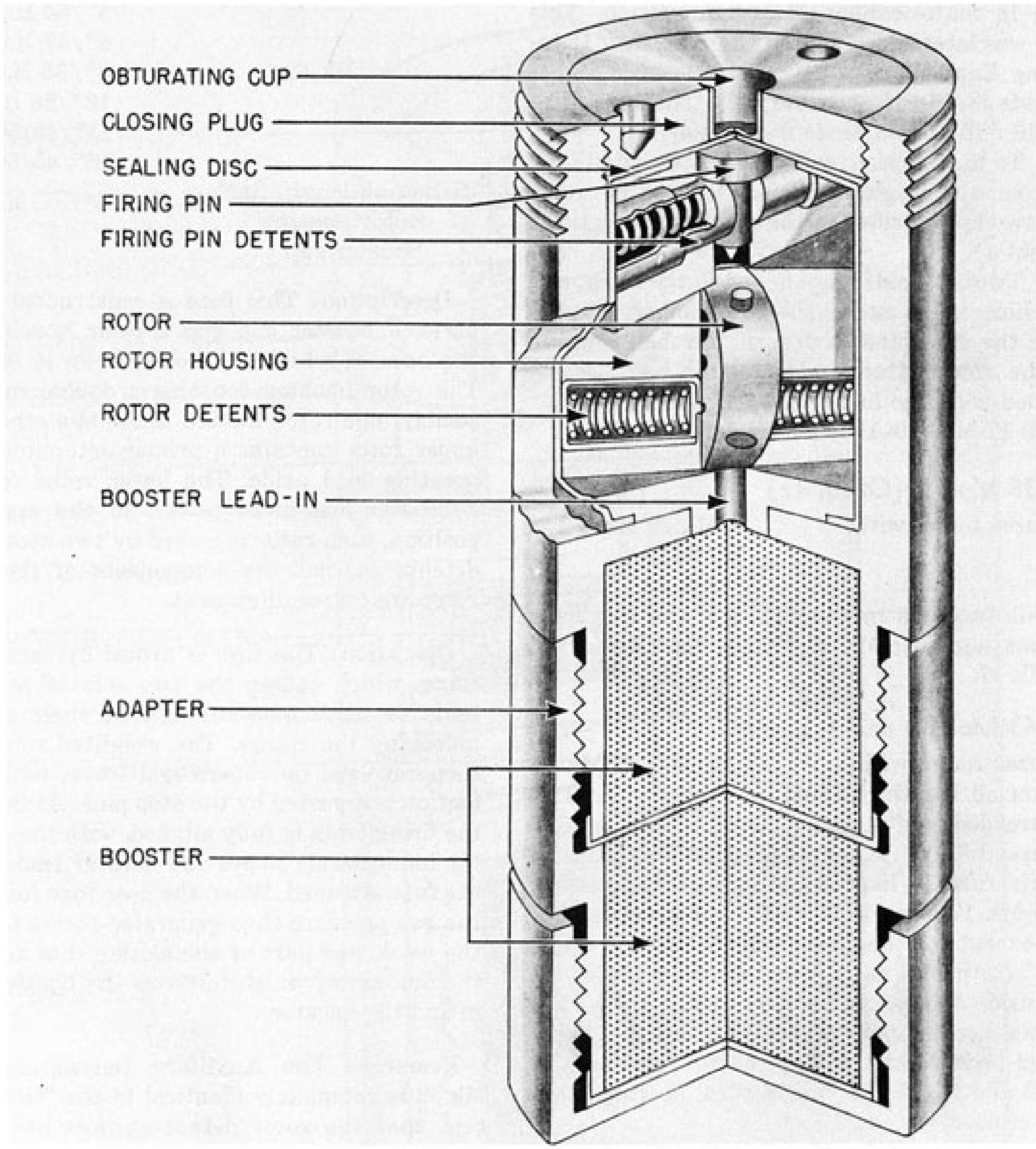


Figure 98. Auxiliary Detonating Fuze Mk 43 Mod 1

redesignation of the Mk 17 Mods 8–13. See Mk 17, "Remarks."

Mk 54 Mods 0 and 1

This fuze is exactly like the Auxiliary Detonating Fuze Mk 46, except that this fuze has a lead azide rather than fulminate of mercury detonator, and also a pointed firing pin instead of a blunt one.

The Mod 1 has an aluminum instead of a steel body, as the Mod 0 has.

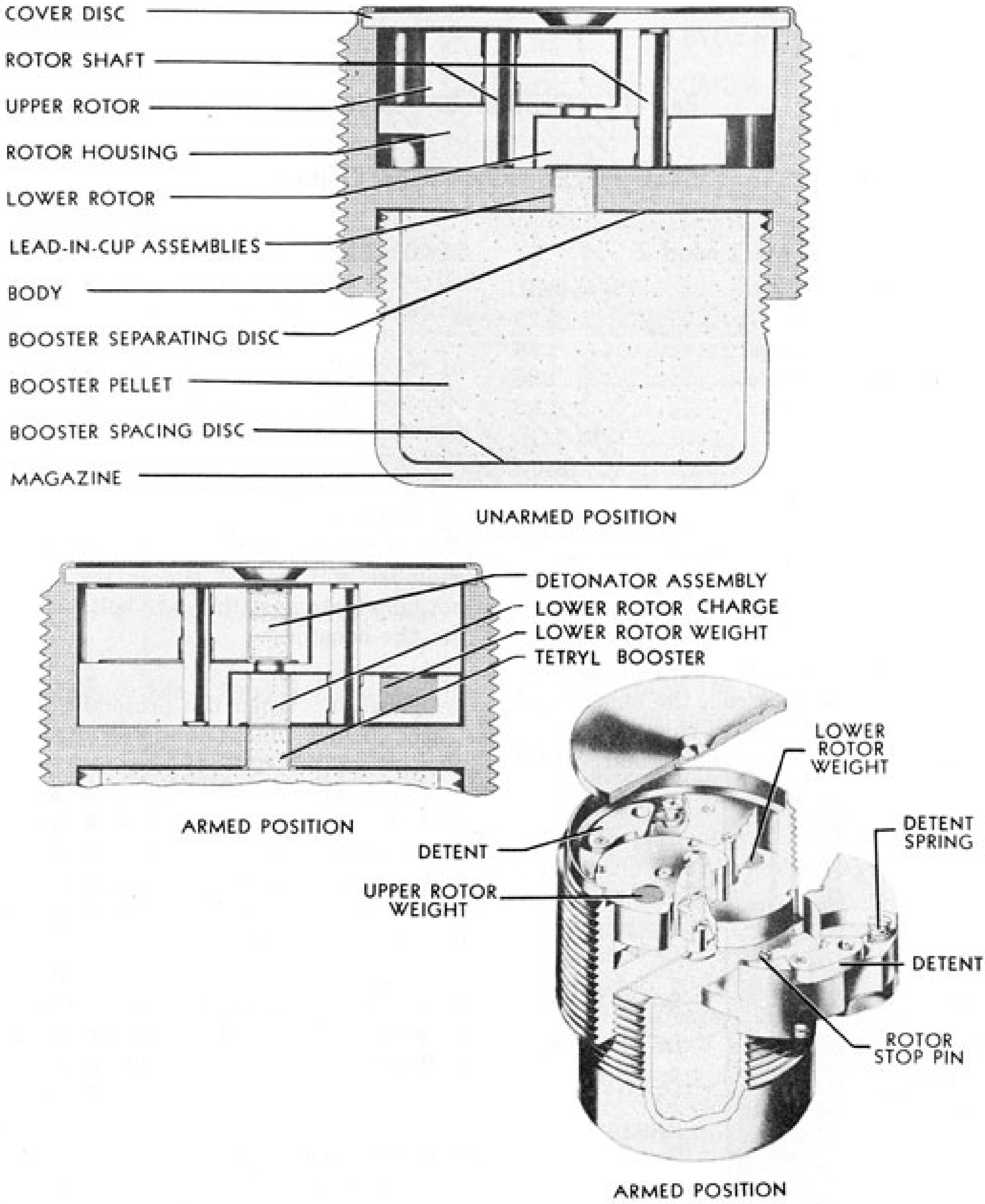


Figure 99. Auxiliary Detonating Fuze Mk 44 Mod 0

Mk 55 Mods 0 and 1

This fuze is exactly like the Auxiliary Detonating Fuze Mk 17 Mod 8 (Mk 35), except that it has a lead azide detonator—for longer life—and a pointed firing pin.

Mod 1 of this fuze has an aluminum body; Mod 0 has a steel body.

BASE FUZES FOR PROJECTILES

Base Detonating Fuze Mk 2 Mod 2

Projectiles used in	7"/45 A.P.
Over-all length, inches	7.25
Diameter of body, inches	1.38
Diameter of head, inches	1.80
Threaded length, inches	1.25
Threads	13 L.H.
Material	Steel

Description: This fuze consists of two major parts: (1) a tracer head, threaded externally to screw into the base of the projectile and containing the tracer primer and pyrotechnic components; (2) the fuze body which houses the Semple striker and carrier unit, the primer-detonator tube, the safety coil, the contrifugal bolt assembly, and the booster charge.

In the unarmed position, the striker, which is pivoted in the striker carrier, is held in the offset position by a pair of centrifugal lock bolts. These bolts are housed in the striker carrier and engage the hole in the weighted end of the striker. Also, in the unarmed position, the detonator is separated from the booster charge by a pair of centrifugal gate bolts. Additional safety is provided by encasing the detonator in a small expansion chamber surrounded by a heavy steel safety coil. Accidental explosion of the detonator will expand itself in the chamber and against the safety coil, and will not penetrate past the gate bolts sufficiently to fire the booster.

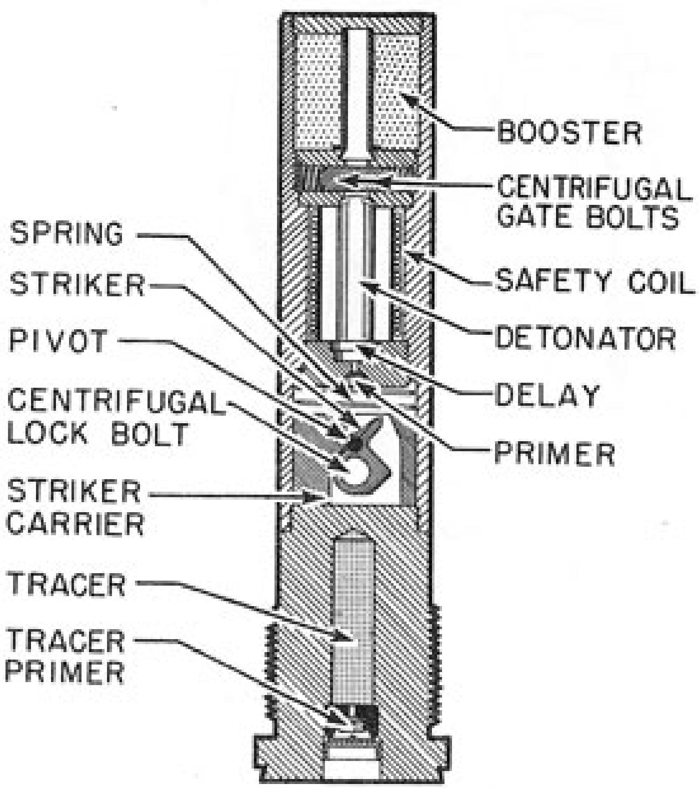


Figure 100. Base Detonating Fuze Mk 2 Mod 2

Operation: When the projectile is fired, the tracer primer functions and ignites the tracer element in the base of the fuze. Centrifugal force causes the centrifugal lock bolts and the centrifugal gate bolts to move outward against their springs. This provides free access between the detonator capsule and the booster charge, and unlocks the pivoted striker. Since the striker is heavily weighted on its lower end, centrifugal force causes the striker to rotate around its pivot and align the striker point with the primer. On impact, the striker carrier moves forward against its spring, bringing the striker against the primer, which fires the delay element and the detonator. The flash from the detonator passes by the open gate bolts and initiates the booster charge, firing the projectile.

Remarks: Because of the shape of the striker, the force of initial acceleration prevents centrifugal force from producing alignment while the projectile is still in the bore of the gun. When acceleration ceases, centrifugal force revolves the pivoted striker to the armed position.

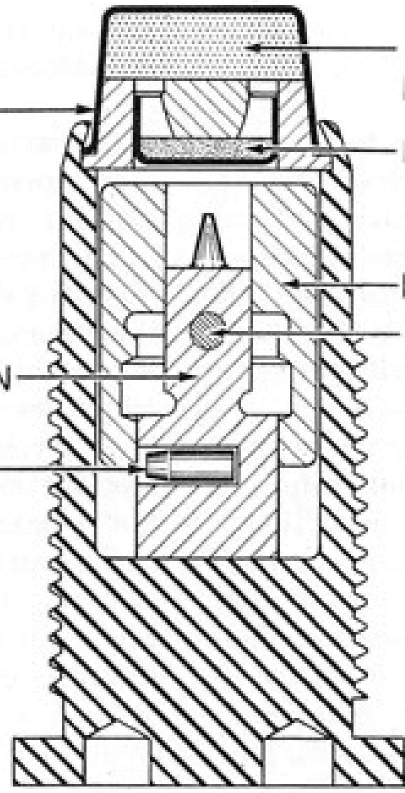


Figure 101. Base Ignition Fuze Mk 2 Mod 9

Base Ignition Fuze Mk 2 Mod 9 (Obsolete)

Projectiles used in
3"/23 Common
1-pdr./40 Common
3-pdr./50 Common
6-pdr./40/42/45/50 Common

Over-all length, inches 1.75
Diameter of head, inch 0.875
Diameter of body, inch 0.63
Threaded length, inch 0.80
Threads .... 16 L.H.
Material .... Body—brass
Plunger—brass
Firing pin—steel

Description: The fuze consists of a brass fuze body housing a firing pin and a plunger assembly. The firing pin and plunger are locked together by a copper shear pin, in the unarmed position. A primer and black powder magazine are crimped to the upper end of the fuze body.

Operation: When the projectile is fired from the gun, the force of set-back drives the plunger back toward the head of the fuze, shearing the copper pin locking the plunger to the firing pin. When the plunger has moved back sufficiently, the lock pin in the firing pin is caused by centrifugal force to move into the groove cut in the interior of the plunger body. The two units are again locked together, but the plunger is now in the lower position. On impact, inertia forces both the plunger and the firing pin forward, driving the firing pin into the primer and initiating the black powder ignition charge. This fires the black powder/TNT main charge in the projectile.

Remarks: No anti-creep spring is incorporated in the assembly of this fuze. Once set-back has ceased and the plunger and firing pin are locked together by the lock pin, there is nothing present in the fuze to prevent their movement forward toward the primer.

Base Detonating Fuze Mk 3 Mod 2 (Obsolete)

Projectiles used in..... 6"/50/53 Common
7"/45 Bombardment
14"/45/50 Bbt.

Over-all length, inches 6.85
Body diameter, inches 1.375
Head diameter, inches 1.80
Weight, pounds 2.58
Threaded length, inches 1.25

Threads ....13 L.H.
Material ....Steel

Description: This fuze consists of two major parts: (1) a tracer head, threaded externally to screw into the base of the projectile and containing the tracer primer and pyrotechnic components; (2) the fuze body, which houses the Semple firing pin and firing-pin housing, the primer-detonator assembly, the centrifugal half-blocks, the safety coil, and the booster.

In the unarmed position, the firing pin, which is pivoted in its housing, is held offset from the primer by a pair of centrifugal detents. These detents are housed in the firing-pin housing and engage the hole in the weighted end of the firing pin. Also, in the unarmed position, the detonator is separated from the booster by a pair of centrifugal half-blocks. Each half-block is TNT stemmed to form a booster lead-in, but the stemmed portions of the two half-blocks are out of alignment in the unarmed position, providing a safety interruption in the explosive train. Additional safety is provided by encasing the detonator in a small expansion chamber surrounded by a safety coil. Accidental explosion of the detonator will expend its force against the safety coil and will not fire the stemmed half-blocks or the booster.

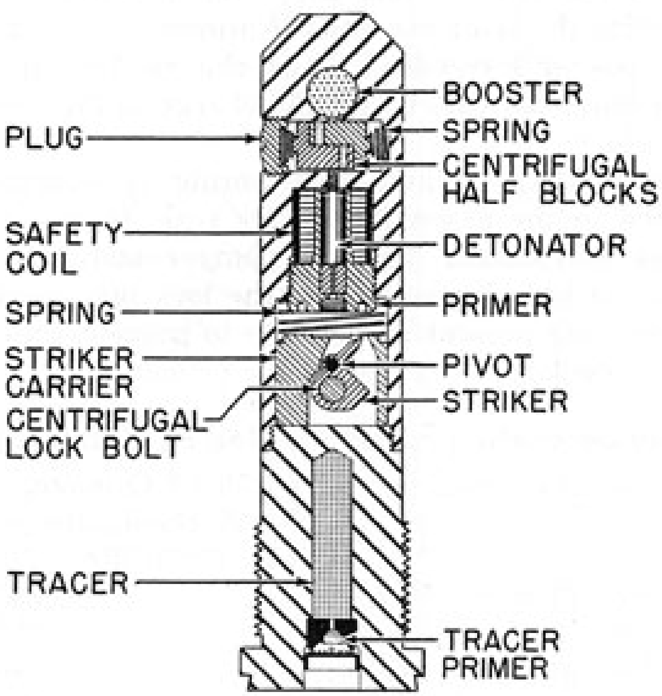


Figure 102. Base Detonating Fuze Mk 3 Mod 2

Operation: When the projectile is fired, the tracer primer functions and ignites the tracer element in the base of the fuze. Centrifugal force causes the centrifugal detents and the centrifugal half-blocks to move outward against their springs. This aligns the booster lead-ins in the half-blocks and unlocks the pivoted firing pin. Since the firing pin is heavily weighted on its lower end, centrifugal force rotates it about its pivot and brings its point into alignment with the primer. On impact, the firing-pin housing moves forward against the anti-creep spring, bringing the firing pin against the primer, which, in turn, fires the detonator. The flash from the detonator initiates the stemmed lead-ins in the half-blocks, the booster charge, and finally the projectile.

Remarks: Because of the shape of the striker, the force of the initial acceleration prevents centrifugal action from aligning the firing pin until after the projectile has left the bore of the gun. When acceleration ceases, centrifugal force revolves the pivoted firing pin to the armed position.

Base Ignition Fuze Mk 8 Mods 4 and 5 (Obsolete)

Projectiles used in....1-, 3-, and 6-pounders
3″/23 Common
Over-all length, inches....Mk 8 Mod 4—3.61
Mk 8 Mod 5— —
Diameter, inch ....Head—0.875
Body—0.625
Weight..........Mk 8 Mod 4—129.7 grams
Mk 8 Mod 5—2.40 ounces
Threaded length, inch..................1.0
Threads ....18 L.H.
Material...Body—brass or bronze
Plunger post and plunger—brass
Striker—cold rolled steel

Description: The body of the fuze contains the plunger and the plunger post which is fitted to the plunger by a shear pin. The striker is attached by a hinge pin to the plunger.

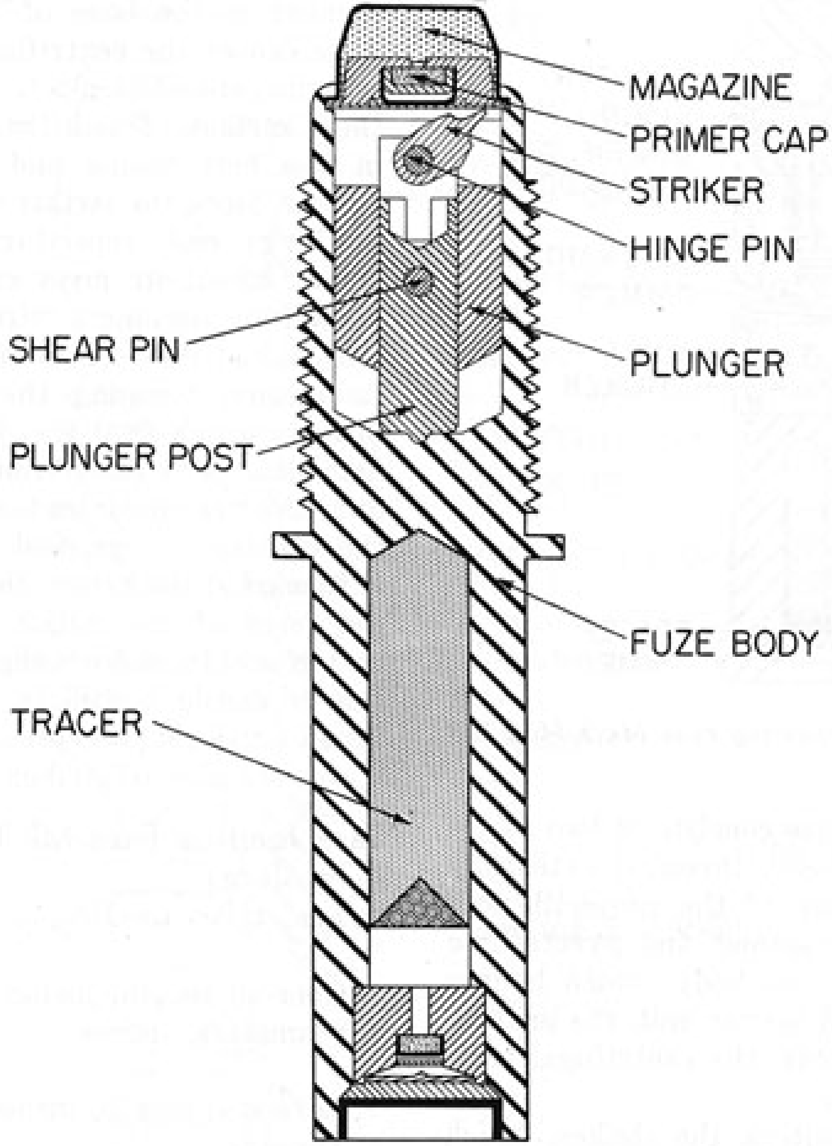


Figure 103. Base Ignition Fuze Mk 8 Mod 4

The primer-magazine unit is held to the body by upsetting the end inward.

Operation: The fuze is assembled with the plunger in the forward position and the striker rotated on the hinge pin, which fastens the striker to the plunger so that it is not aligned with the primer. The force of set-back cuts the shear pin, allowing the plunger to ride back on the plunger post. This motion carries the striker, which straightens out as it enters the recess in the end of the plunger post and then points at the primer cap. On impact the plunger and plunger post go forward together and fire the primer, which ignites the magazine.

Remarks: While this is not a centrifugally actuated fuze, the firing pin is not aligned with the primer until after set-back and cannot be so aligned until the plunger has moved relative to the plunger post.

Base Ignition Fuze Mk 8 Mod 4 differs from Mod 5 only in that it has the longer body with the integral external tracer assembly.

Base Detonating Fuze Mk 9 Mod 2

Projectiles used in	7"/45 A.P.
Over-all length, inches	6.62
Body diameter, inches	1.38
Diameter of head, inches	1.80
Threaded length, inches	1.25
Threads	13 L.H.
Material	Tracer head—steel Fuze body—brass

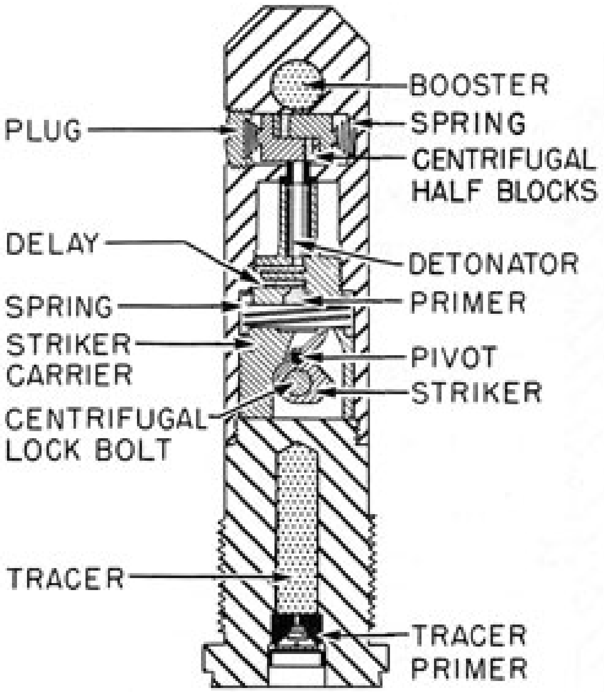


Figure 104. Base Detonating Fuze Mk 9 Mod 2

Description: This fuze consists of two major parts: (1) a tracer head, threaded externally to screw into the base of the projectile and containing the tracer primer and pyrotechnic components: (2) the fuze body, which houses the Semple striker and carrier unit, the primer-delay-detonator assembly, the centrifugal half-blocks, and the booster.

In the unarmed position, the striker, which is pivoted in the striker carrier, is held offset from the primer by a pair of centrifugal lock bolts. These bolts are housed in the striker carrier and engage the hole in the weighted end of the striker. Also, in the unarmed position, the detonator is separated from the booster by a pair of centrifugal half-blocks. Each half-block is TNT stemmed to form a booster lead-in, but the two stemmed portions of the half-blocks are out of alignment in the unarmed position, providing a safety interruption in the explosive train. Additional safety is provided by encasing the detonator in a small expansion chamber. Accidental explosion of the detonator will expend itself in the expansion chamber and will not fire the stemmed half-blocks or the booster.

Operation: When the projectile is fired, the tracer primer functions and ignites the tracer element in the base of the fuze. Centrifugal force causes the centrifugal lock bolts and the centrifugal half-blocks to move outward against their springs. This aligns the booster lead-ins in the half blocks and unlocks the pivoted striker. Since the striker is heavily weighted on its lower end, centrifugal force rotates the striker about its pivot and brings the striker point into alignment with the primer. On impact, the striker carrier moves forward against its spring, bringing the striker against the primer, which fires the delay element and the detonator. The flash from the detonator initiates the stemmed lead-ins in the half-blocks, the booster charge, and finally the projectile.

Remarks: Because of the shape of the striker, the force of the initial acceleration prevents centrifugal force from aligning the striker while the projectile is still in the bore of the gun. When acceleration ceases, centrifugal force revolves the pivoted striker to the armed position.

Base Ignition Fuze Mk 10 Mods 3, 4, and 9 (Obsolete)

Projectiles used in	4″/50 Common 5″/50/51 Common
Over-all length, inches	4.12
Diameters, inches	Body—1.05 Head—1.40
Threaded length, inches	1.40
Threads	9 L.H.
Weight, grams	398
Material	Stock—cold rolled steel Striker carrier—brass Firing pin—sheet brass

Description: This fuze consists of a single body unit containing a striker carrier, an anti-creep spring, and a primer-magazine head. An integral tracer is located in the after end of the fuze body. In the unarmed position, as illustrated, the firing pin is held offset from the primer by a pair of centrifugal lock bolts. The firing pin is pivoted in the movable striker carrier, which is held away from the primer by an anti-creep spring.

Operation: When the projectile is fired, the gases from the propelling charge force a small firing pin into the tracer primer, igniting the tracer-starter mixture, which in turn initiates

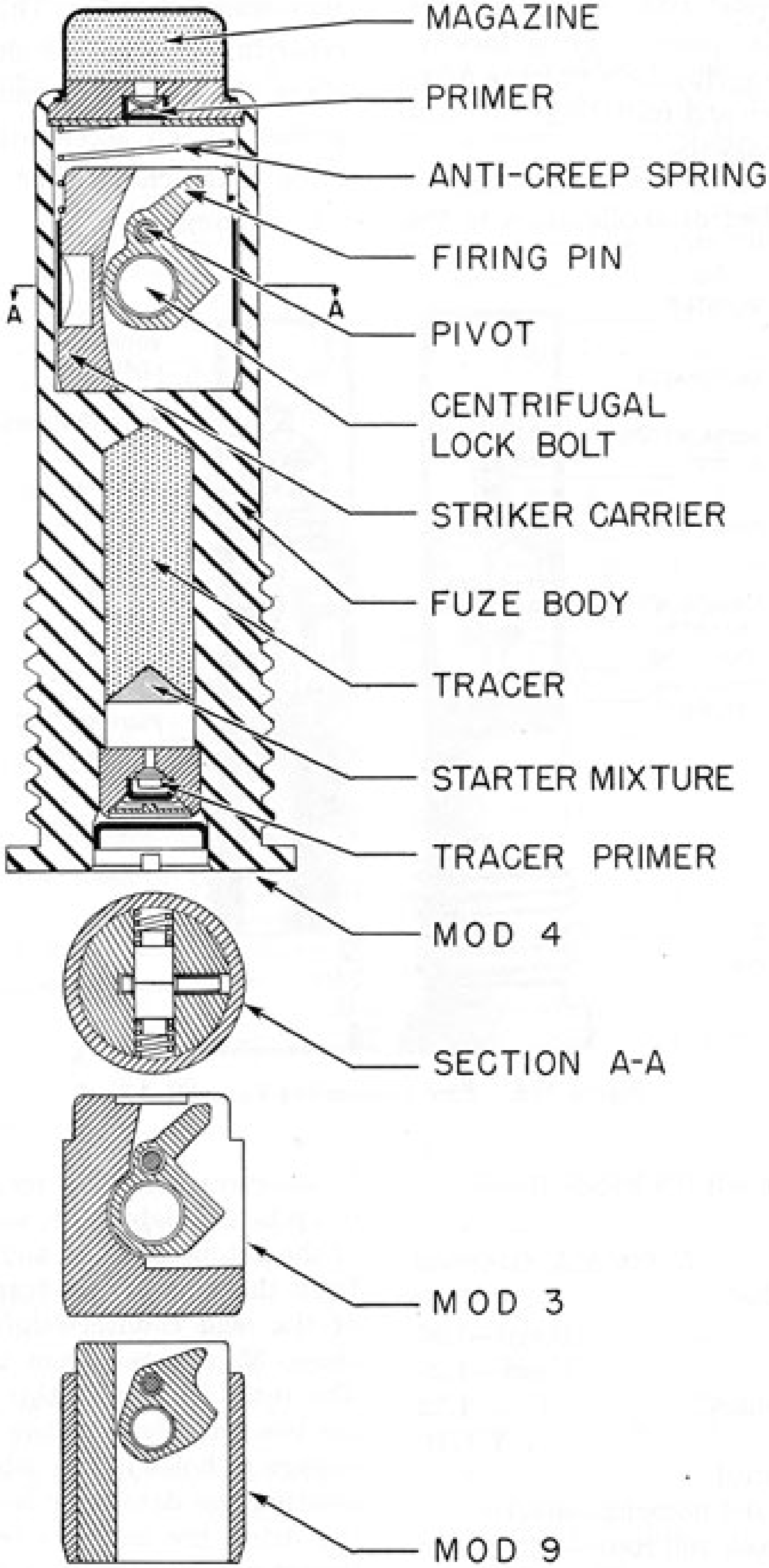


Figure 105. Base Ignition Fuze Mk 10

the tracer pyrotechnic. Centrifugal force causes the two lock bolts to move outward against their spring, unlocking the pivoted firing-pin. The firing pin then rotates into the armed po-

sition, where it is aligned with the fuze primer. On impact, the striker carrier moves forward against the anti-creep spring, bringing the firing pin against the primer and initiating the black powder in the fuze magazine.

Remarks: Because of the peculiar shape of the firing pin, the effect of acceleration in the gun causes it to lag. This force is greater than centrifugal force; so during the acceleration stage the striker cannot align itself with the primer. When acceleration ceases, centrifugal force takes charge and rotates the firing pin into alignment.

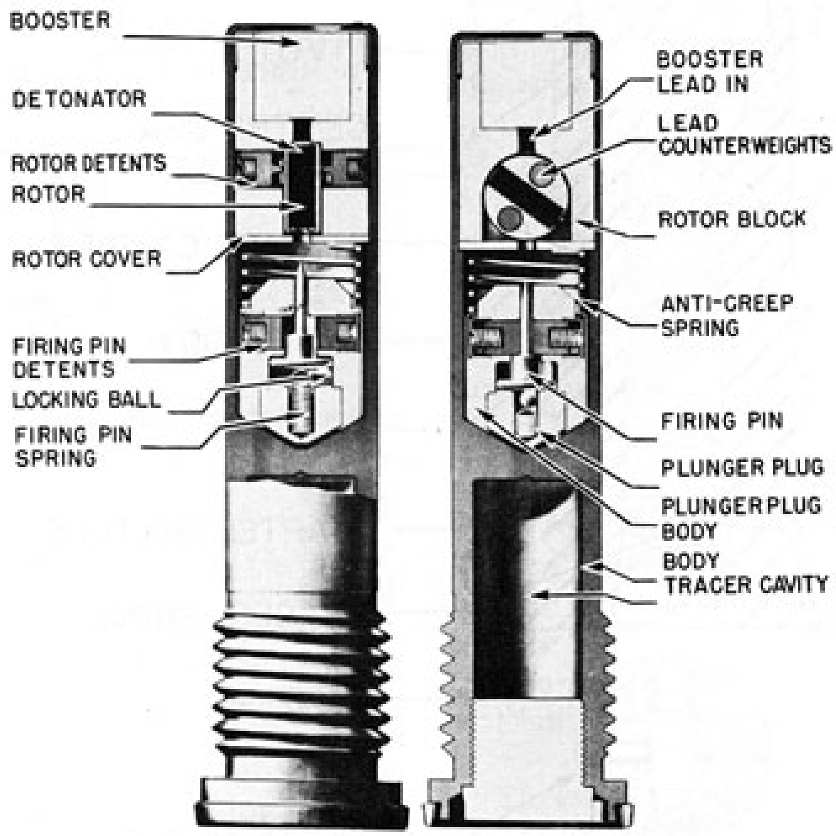


Figure 106. Base Detonating Fuze Mk 13

Base Detonating Fuze Mk 13 Mods 0—7 (Obsolete)

Projectiles used in......5"/38 A.A. Common
Over-all length, inches................5.80
Diameters, inches..............Body—1.05
Head—1.26
Threaded length, inches...............1.22
Threads ....7 L.H.
Material...Body—steel
Striker and housing—steel
Rotor block and rotor—aluminum
Arming speed, r.p.m............3,000–4,000

Description: This fuze consists of a one-piece body which contains two housings, the rotor housing and the firing-pin housing. The rotor housing consists of a rotor, with lead counterweights and detonator, assembled with the axis of the detonator at an angle of about 55 degrees from the axis of the fuze. The line of centers of the lead counterweights is at an angle of about 35 degrees from the axis of the fuze. The rotor is held in this unarmed position by the two rotor detents, the tapered ends of which engage in holes in the side of the rotor. In this position the detonator is out of line with both the firing pin and the booster. The firing-pin housing is free to move and is separated from the rotor housing by a light anti-creep spring. Contained within the housing is a firing pin which is held in position by two firing-pin detents. The point of the firing pin does not pro-

trude from the housing in the unarmed position. Behind the firing pin is a compressed spring and a locking ball tending to throw the firing pin forward.

Operation: When the projectile is fired from the gun, centrifugal force moves the firing-pin detents outward against their springs, thus releasing the firing pin. When the detents are out, the compressed spring moves the firing pin forward and the locking ball moves into the place formerly occupied by the firing pin, thus locking it in a forward position. Centrifugal force also moves the rotor detents back against their springs, thus releasing the rotor. Then centrifugal force, acting upon the lead counterweights in the rotor, causes the rotor to turn until the detonator is in line with the firing pin and booster. In this position the rotor is dynamically balanced, centrifugal force holding the two lead-filled holes at a maximum radius from the axis of rotation of the fuze. Upon impact, the firing-pin housing, being free to move, rides forward against the weak anti-creep spring, causing the firing pin to hit the detonator, which sets off the booster in the base of the fuze.

Remarks: Because of an unacceptable percentage of premature functionings, these fuzes have been recalled.

A cut-off Base Detonating Fuze Mk 13 is occasionally used as a tracer in B.L. & T. projectiles for target practice.

Base Detonating Fuze Mk 19 Mods 0 and 1

Projectiles used in	6"/47/53 Common 6"/53 Sp. Common
Over-all length, inches	6.68
Diameters, inches	Body—1.37 Head—1.80
Threaded length, inches	1.56
Threads	18 L.H.
Material	Body—chrome moly steel Nose cap—duralumin
Delay, second	0.01

Description: The fuze is composed of two major parts, the fuze body and the nose cap. The body contains the auxiliary detonator plunger, the detonator plunger, the detonator-plunger detents, the anti-creep spring assembly, and the firing train. The auxiliary detonator is surrounded by twenty ball bearings and bears against the bottom of the detonator plunger. Fitted over the top of the detonator plunger is the anti-creep spring assembly consisting of an inner and an outer cup separated by an anti-creep spring. The outer cup will not move, and the inner cup is crimped over the top of the detonator plunger and held in position by the sensitive primer holder. The firing train consists of the sensitive primer, secondary firing pin, secondary primer, delay element, detonator, and booster lead-ins and lead-outs which are out of line in the unarmed position.

The nose cap, which is secured to the end of the body by a threaded joint, houses the sensitive firing pin and firing-pin detents. The sensitive firing pin is held in place by two stakes, but is referred to as a "floating" firing pin, since it can move downward slightly. Ninety degrees removed from the two detents are two holes in the nose cap. A locking pin is provided to lock the nose cap in position.

Operation: The force of set-back causes the sensitive firing pin to move down on the firing-pin detents, thus creating friction and holding them in. When the projectile leaves the bore of the gun, creep causes the firing pin to move forward again, thus releasing the firin-pin detents. Centrifugal force will move both sets of detents outward against their springs, and the fuze is then completely armed. The detonator plunger is prevented from moving forward on creep because of the anti-creep spring, but on impact the auxiliary plunger, acting as an inertia weight, pushes the detonator plunger forward. This action moves the inner cup forward, thus compressing the anti-creep spring, and brings the booster lead-ins and lead-outs in line. The sensitive primer in the top of the detonator plunger is carried on to the sensitive firing pin, and the explosion of the sensitive primer accomplishes two things:

1. The gases resulting from the explosion pass through the portholes on the side of the primer container and build up a high pressure, expanding that part of the cup which is adjacent to the holes in the nose cap. This action

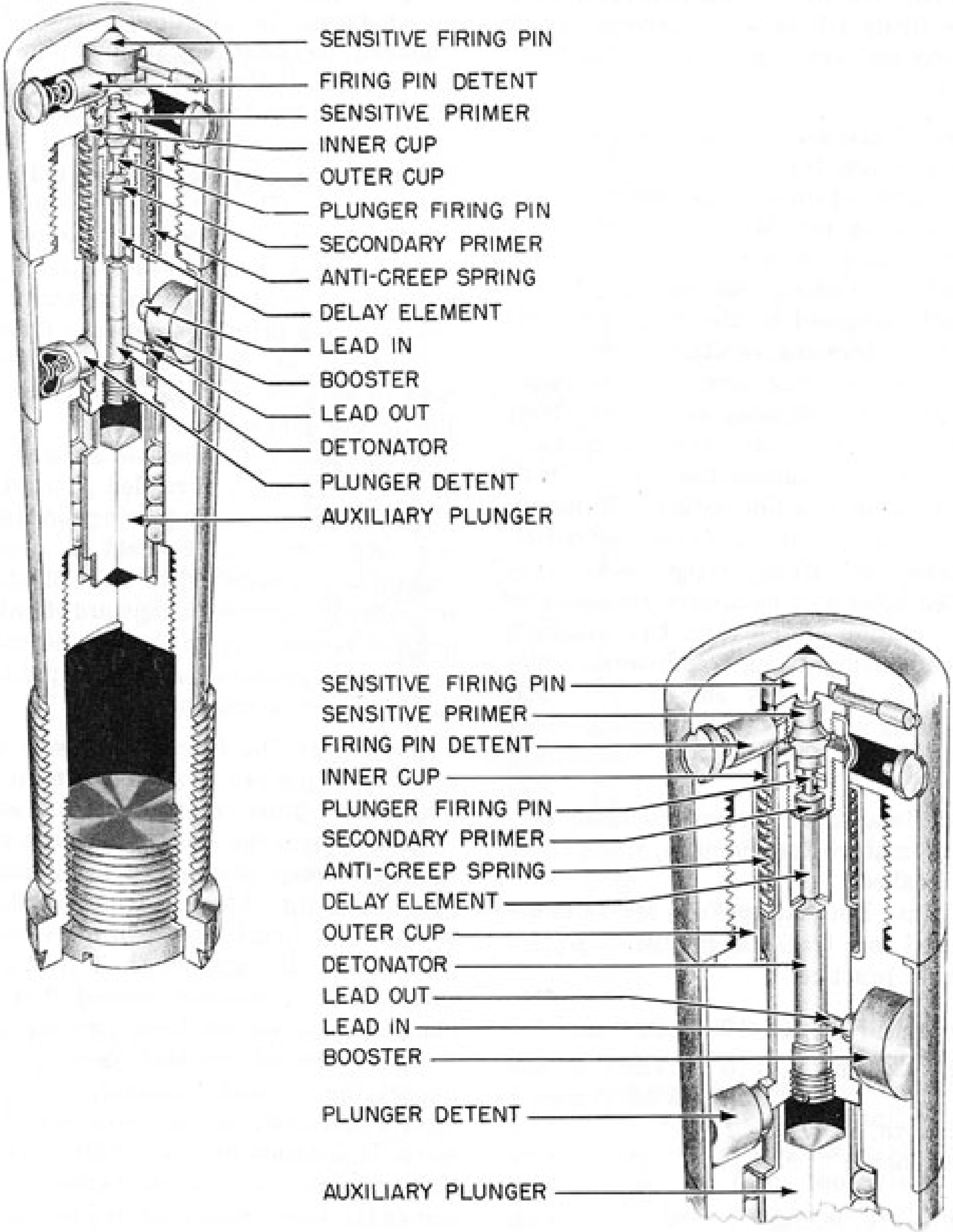


Figure 107. Base Detonating Fuze Mk 19

locks the detonator plunger in the fired position and keeps the firing train lined up.

2. The shear wire that has been holding up the secondary firing pin is broken, and the secondary firing pin is driven down into the secondary primer, thus setting off the delay element of 0.01 second and the detonator and booster elements.

Remarks: This fuze will function on four-inch plate and on water.

The Base Detonating Fuze Mk 19 Mod 1 is

fully moisture-resistant, as described for the Base Detonating Fuze Mk 28. This is its only difference from the Mod 0.

Base Detonating Fuze Mk 20 Mods 0–2

Projectiles used in......4″/50 Sp. Common
5″/38 Sp. Common
5″/38 Common
Threaded length, inch..................0.96
Threads ....11 L.H.
Material ....Body—manganese steel
Nose cap—duralumin
Delay, second 0.01

Except for the dimensions noted above, the Base Detonating Fuze Mk 20 is the same as the Mk 19.

Mods 1 and 2 of this fuze, representing different manufacturers, differ from the Mod 0 only in being fully moisture-resistant.

Base Detonating Fuze Mk 21 Mods 0 and 1

Projectiles used in
6″/47 A.P., 8″/55 Common
7″/45 A.P., 8″/55 Sp. Common
8″/55 A.P.
12″/50 A.P.
14″/45/50 A.P.
16″/45/50 A.P.
Threaded length, inch..................0.96
Threads ....11 L.H.
Material........... Body—manganese steel
Nose cap—duralumin
Delay, second 0.035

Description: Except for the dimensions noted above, the Base Detonating Fuze Mk 21 is like the Mk 19, and has practically the same operation; however, this fuze is designed with an additional plunger-locking unit. The plunger body is drilled in four places, and four balls are placed in the holes. On forward motion of the plunger and under centrifugal action, the locking balls fly out of their recesses into the forward or larger-diameter portion of the body, locking the plunger in the forward position. This locking feature is provided to insure alignment of booster lead-ins and detonator lead-outs during the long delay period, when the projectile is subjected to violent shocks of penetration.

Remarks: The detent springs in this fuze are considerably weaker than those used in the Base Detonating Fuze Mk 28.

The Mod 1 of this fuze is identical to the Mod 0, except that it is fully moisture-resistant.

Base Detonating Fuze Mk 23 Mod 0 (Obsolete)

Projectiles used in.......8″/55 Common
8″/55 Sp. Common
8″/55 A.P.
Over-all length, inches................7.80
Diameters, inches ....Head—1.8
Body—1.38
Threaded length, inches...............1.25
Threads ....13 L.H.
Weight............2 lb. 7 oz. without tracer
Material ....Cadmium plated steel
Arming speed, r.p.m. 1,200–1,400
Delay, second 0.035

Description: The fuze is composed of three major parts: the head, the body, and the nose cap. The fuze head assembly contains the firing pin, firing pin detents, and two locking balls behind the firing pin. In the assembled position, the point of the firing pin does not protrude from the head. The body contains the detonator plunger, which is spring-loaded downward toward the firing pin by a very heavy firing spring. The firing train—consisting of the sensitive primer, the secondary primer, the delay element, the detonator, and the booster elements—is contained within the detonator plunger. Plunger alignment is maintained by pins in the plunger stock. The nose cap contains the ball retainer, ball retainer detents, and locking balls. The spring-loaded plunger is held up by the locking balls, which are, in turn, held in by the ball retainer. The ball retainer is prevented from moving because of the ball retainer detents.

Operation: When the projectile is fired, centrifugal force causes the firing-pin detents and ball-retainer detents to be moved outward against their springs. When the firing-pin detents have moved out, the firing pin moves forward because of creep, and the locking balls

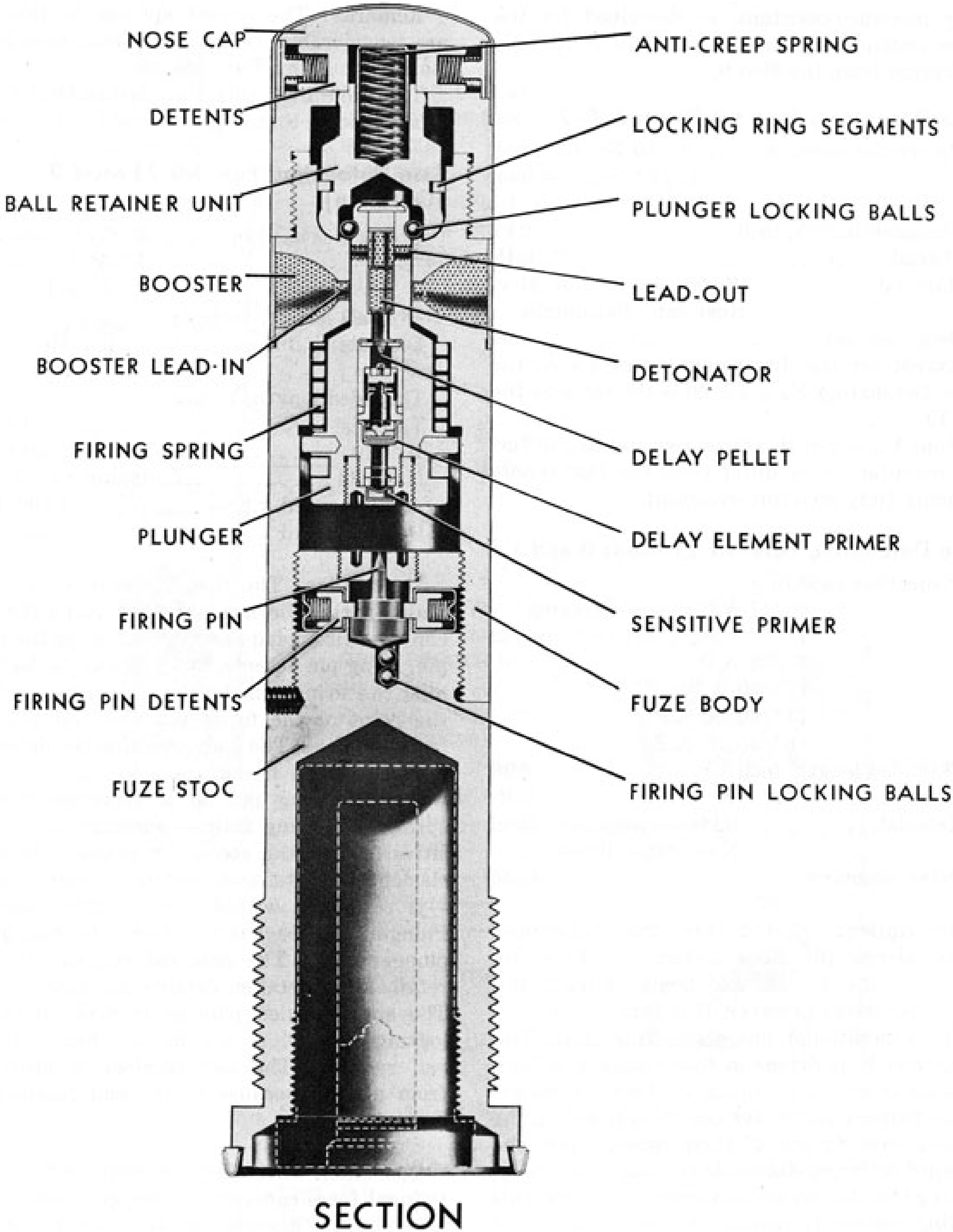


Figure 108. Base Detonating Fuze Mk 23

drop into the space left by the forward movement of the firing pin and will be held outward by centrifugal force, thus locking the firing pin in the forward position. The ball retainer is prevented from moving forward under influence of creep, because of the anti-creep spring behind it. On impact, the ball retainer moves forward until stopped by the nose, and is locked in this position by three split ring segments engaging a shoulder at the end of the body. The plunger-locking balls are released by this forward movement of the ball retainer and are projected outward. When the force of impact has diminished sufficiently to permit the firing spring to propel the plunger to the rear, the sensitive primer in the base of the plunger is thrown down on to the firing pin. When the plunger moves down, it brings the booster lead-ins and lead-outs in line, and the plunger is locked in the rear position by three split ring segments in a manner similar to the ball retainer. When the sensitive primer is fired, the gas from it fires the percussion primer. The flash from the percussion primer passes through and around the baffle and ignites the delay pellet. This defers ignition of the detonator for 0.02 second. The detonator then fires the booster elements.

Remarks: This fuze will detonate on thin plate and on water impact.

Base Detonating Fuze Mk 28 Mods 0—17

Projectiles used in
4"/50 H.C.
5"25/38/51 A.A. Common
5"/51/54 H.C.
6"/50 Common
6"/47/53 H.C.
7"/45 Bombardment
8"/55 H.C. and Sp. Common
14"/45/50 Bombardment
"Green Stripe"
12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

Threaded length, inches 0.96
Threads . . . . 11 L.H.
Weight . . . . 2 lb. 6 oz.
Material . . . . Body—manganese steel
Nose cap—duralumin (unpainted)
Arming speed, r.p.m. 3,000–4,000
Delay . . . . None

Except for the dimensions and delay noted above, the Base Detonating Fuze Mk 28 is like the Mk 19.

Remarks: The fuze will function on 1/4- to 1/2-inch plate and on water.

The special "green stripe" Base Detonating Fuze Mk 28 was issued for major-caliber H.C. projectiles, but is being replaced by the Mk 39.

Mods 0 to 14 represent different manufacturers.

Mods 15 and 16 are identical to earlier Mods, but are fully moisture-resistant, with a silica gel capsule in the auxiliary detonator plunger and all external joints coated with bakelite varnish over a lacquer base. Mod 17 has an additional booster charge.

Base Detonating Fuzes Mk 31 and Mk 36

Projectiles used in . . . . 4"/40 H.C.
Markings . . . . B.D.F. Mk 31 Lot—
Over-all length, inches 4.68
Delay, second . . . . Mk 36—0.01
Mk 31—None

Remarks: This fuze is moisture-resistant. These fuzes are almost identical to the Base Detonating Fuze Mk 28, differing only in length. Because of the small explosive cavity in the 4-inch projectile, the Base Detonating Fuzes Mk 31 and Mk 36 have been made two inches shorter, with an external tracer.

Mk 31 and Mk 36 differ in the following:

Mk 36 has a delay of 0.01 second; Mk 31, no delay.

Mk 36 has a stronger anti-creep spring.

Mk 36 has a chrome-molybdenum detonator plunger; Mk 31, a pearlite manganese steel one.

Base Detonating Fuze Mk 39 Mod 0 (Obsolete)

Projectiles used in . . . . 8"/55 H.C.
12"/50 H.C.
14"/45/50 H.C.
16"/45/50 H.C.

This fuze is a modified Base Detonating Fuze Mk 28, the only change being that the springs behind the detents have been made weaker. It is a Mk 28 with the detent springs of a Mk 21. The reason for this change was as follows. At long ranges in major-caliber guns, there was not sufficient centrifugal force to keep the fuze in an armed condition. It was formerly designated the Base Detonating Fuze Mk 28 Sp. and was identified by a green stripe around the body, but this has been replaced by the new Mark number.

This fuze is being replaced by the Base Detonating Fuze Mk 48.

Base Detonating Fuze Mk 48 Mods 0 and 1

The Mk 48 is exactly like the Mk 39, except that the Mk 48 has a 0.01-second delay element.

Base Donating Fuze Mk 64

Projectiles used in.............5"/54 Special Common

In order to incorporate the stronger body of the Base Detonating Fuze Mk 21 Mod 1 with the detonator plunger and the 0.01-second delay of the Mk 36 Mod 0, this fuze is constructed as follows: (1) fuze body, anti-creep-spring outer cup, and plunger-retaining cup of the Base Detonating Fuze Mk 21 Mod 1; (2) detonator plunger assembly of the Mk 36 Mod 0; (3) anti-creep spring and all other components of the Mk 31 Mod 0.

Base Detonating Fuze M66A1

Projectiles used in	3"/50 A.P.
Over-all length, inches	3.45
Threaded length, inch	0.5
Threads	5 L.H.
Total weight, pound	1.0
Material	Body—steel Striker—brass
Delay, second	0.016

Description: This fuze is assembled in two parts, and, when assembled in the projectile, extends from the base of the projectile in the form of a boat-tail. Contained within the body itself is a heavy brass plunger, which acts as a striker; and fitting under the striker is a soft brass washer, which acts as a shear washer. Beneath the striker, and contained in a separate unit which threads into the body, is a container for the delay element, detonator, and booster. The cavity in the head of the fuze houses the built-in tracer element.

Operation: There are no arming principles in this fuze; and on impact the inertia action of the heavy striker collapses the brass washer, allowing the striker to initiate the primer, which sets off the detonator and booster after a short delay period.

Remarks: This is an Army fuze which has been adopted by the Navy. No Navy Mark has been assigned to this fuze, and it is referred to by its "M" designation.

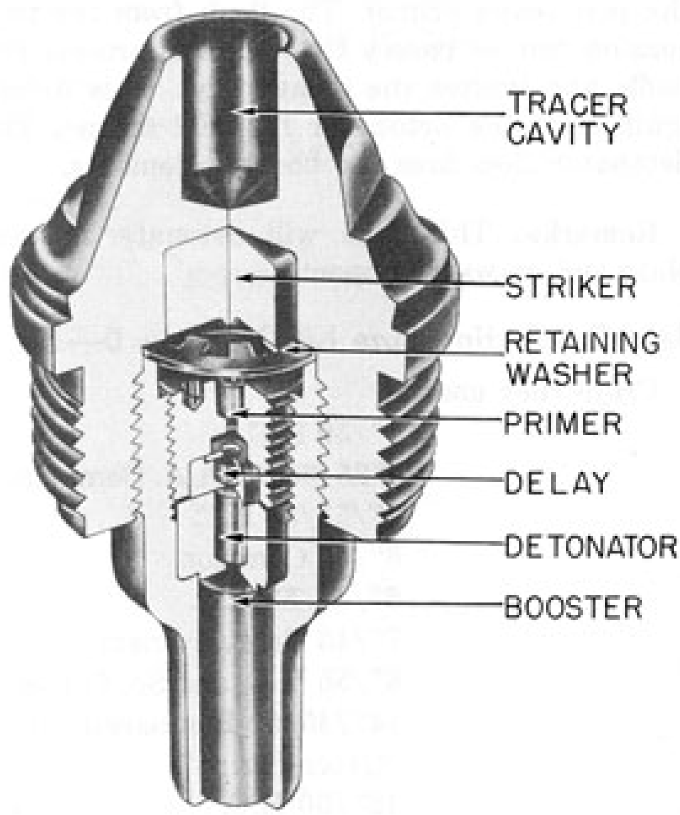


Figure 109. Base Detonating Fuze M66A1

PRIMERS AND TRACERS

Section I — INTRODUCTION

Primers

When used in connection with gun ammunition, the term "primer" means the small tube of sensitive explosive which initiates the burning of the propellant charge. Primers are threaded into the base of the cartridge case in case-gun ammunition. For bag guns, the primer is inserted in the primer lock of the breech plug. Primers are classified according to the means of activating them, as follows,

Percussion—impact-fired
Electrical—fired by electricity
Combination—fired by either percussion or electricity

Lock primers: The term "lock" refers to the breech-plug lock of a bag gun; hence, these are bag-charge primers.

Construction: Large-size primers have a main tube, or body; an ignition tube; and a cap, or caps. Activation of the cap, by electricity or percussion, sets off the powder in the ignition tube, which then ignites the powder outside the ignition tube. The ignition tube and the main tube have holes spaced along their length, to provide even burning and ignition over a wider area of the next respective charge.

Percussion caps have a hammer-and-anvil construction to insure impact over a wide area of the explosive.

Electric caps consist of a platinum or other resistance wire "bridge" wrapped with gun cotton. Heat from the bridge ignites the gun cotton for firing.

Charges: The explosive in percussion caps may be a mixture of the following: fulminate of mercury, potassium chlorate, TNT, lead sulfocyanate, antimony sulfide, or pentaerythritol tetranitrate.

In electric caps, black powder is usually packed with the gun cotton.

For the main charge, black powder or a mixture of black powder and cannon powder is the standard.

Tracers

Tracers are devices designed to leave a trace of either smoke or flame, showing the trajectory of the projectile. They are either screwed or pressed into the after end of the projectile, and may be set into the interior of the projectile, in which case they are internal tracers; or they may project from the end of the projectile, in which case they are called external tracers. Tracers may be ignited by the heat from the burning of the propelling charge, or may be equipped with a striker and detonator which ignites the tracer when the force of set-back occurs.

Some tracers are designed to detonate the explosive charge—"self destruction"—in the projectile when the illuminant material has been burned out by the flame from the tracer igniting a detonator, which, in turn, ignites the main charge.

PRIMERS

Percussion Primer Mk 10 Mods 8 and 9

Over-all length, inches 2.21
Diameter of body, inch 0.375
Material .... Brass
How secured .... Push fit
Charge .... 10 grams black powder
26 grams cannon powder
Cap .... Commercial mixture of mercury fulminate, potassium chlorate, and antimony sulfide
Guns used in .... 3"/23; 1-, 3-, and 6-Pounder

Primer Mk 10 Mod 8 is similar to the Mk 10 Mod 9, but is authorized for use with saluting charges only.

Combination Primer Mk 13

Over-all length, inches 9.745
Diameter of body, inch 0.538
Material .... Brass
How secured .... Screwed in case
Charge .... 265 grams black powder in primer
Cap .... Mixture of potassium chlorate, antimony sulfide, and mercury fulminate; also, platinum electric bridge and gun cotton
Guns used in .... 4"/50, 5"/38, 5"/25, 5"/51, 6"/47 case guns

Percussion Primer Mk 14

Over-all length, inches 5.021
Diameter of body, inch 0.55
Material .... Brass
Method of securing .... Screwed into case by 11 R.H. threads
Charge .... Black powder
Cap .... Mercury fulminate, antimony sulfide, and potassium chlorate
Guns used in .... 3"/50

Lock Combination Primer Mk 15 Mod 1

Over-all length, inches 1.985
Diameter of body, inch 0.492
Material .... Bronze
How secured .... Push-fit in breech plug of gun
Charge .... 30 grams black powder
Cap .... Mercury fulminate, antimony sulfide, and potassium chlorated; also, platinum bridge and gun cotton for electric firing
Guns used in .... All bag guns

Percussion Primer Mk 19 Mod 0 (Obsolete)

Over-all length, inches 1.71
Diameter of body, inch 0.54
Material .... Brass
How secured .... Push fit
Charge .... 28 grains Army black powder
Cap .... Mixture of TNT, antimony sulfide, and potassium chlorate
Guns used in .... 1.1"

Percussion Primer Mk 21 Mods 0 and 1 (Obsolete)

Over-all length, inches .... 2.9 (approx.)
Diameter of body, inch 0.54
Material .... Brass
How secured .... Screws into case; R.H. threads
Charge .... 64 grains black powder
Cap .... Mixture of lead sulfocyanate, potassium chlorate, and antimony sulfide
Gun used in .... 40-mm Brass Case Mk 1

Percussion Primer Mk 22

This primer is exactly like the Percussion Primer Mk 21, except that it is secured by a

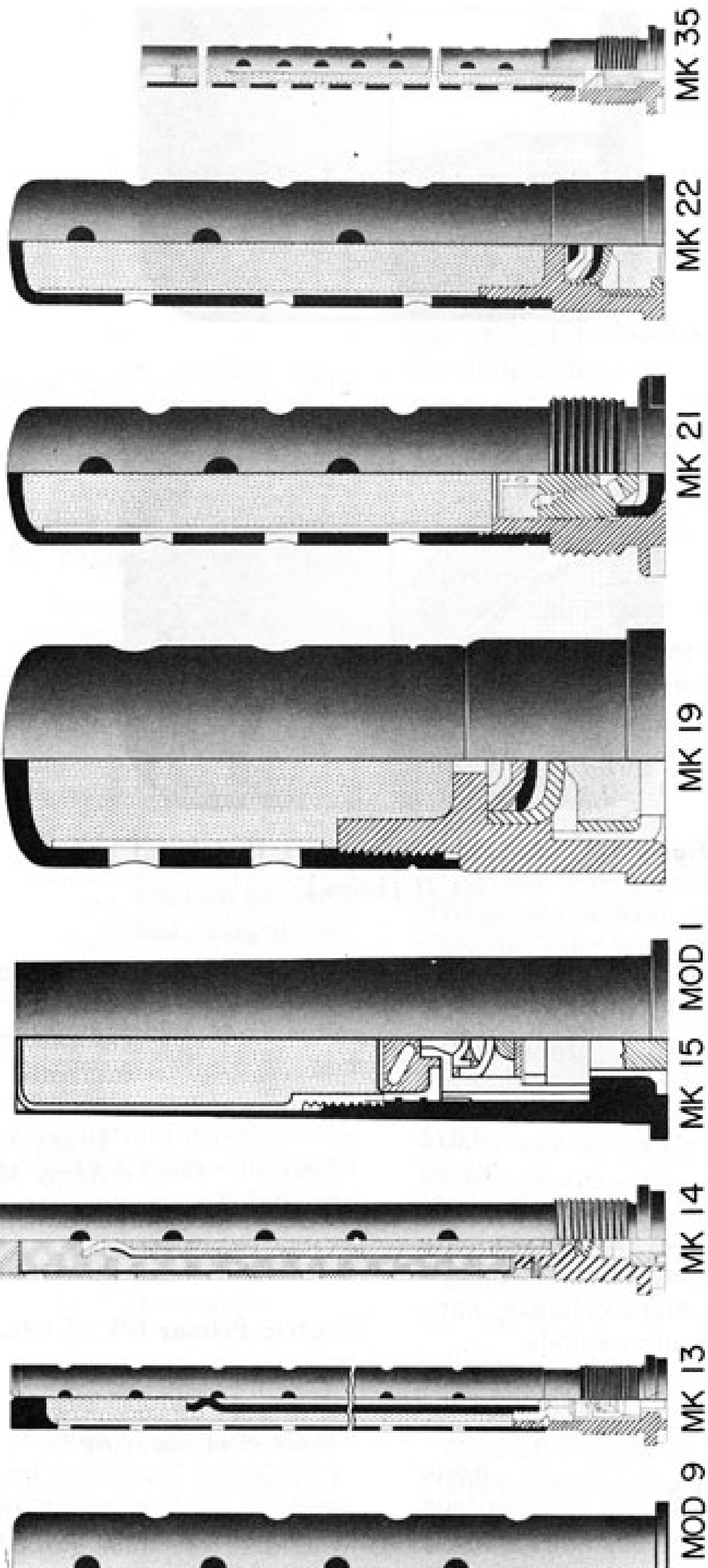


Figure 110. Primers (not proportionate sizes)

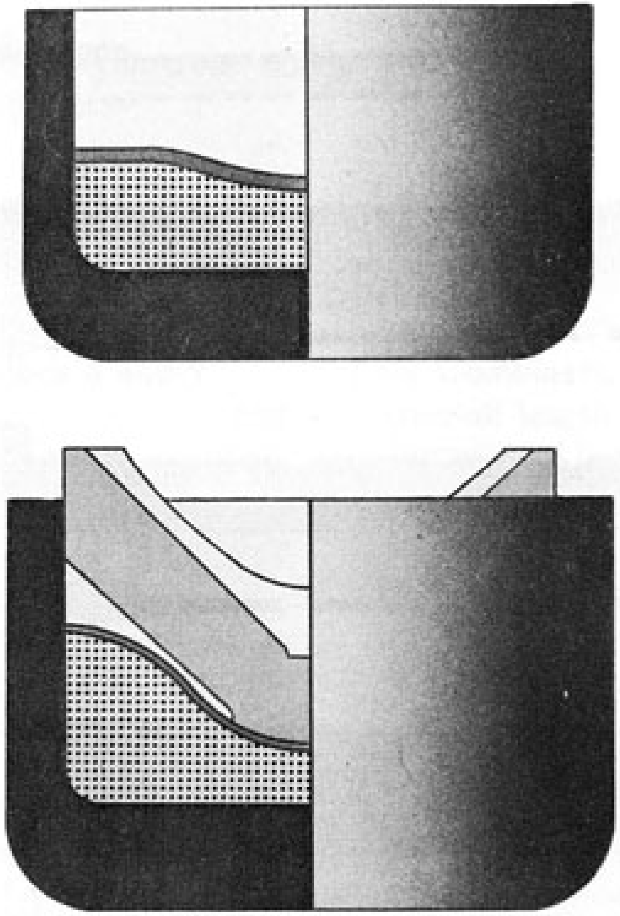


Figure 111. Percussion Primers Mk 30 (above) and Mk 31 (below)

push-fit rather than threads. The Mk 22 is used in 40-mm Brass Case Mk 1 and Steel Case Mk 3.

Percussion Primer Mk 30

Over-all length, inch 0.2
Diameter of body, inch 0.314
Material .... Brass
Method of securing .... Press-fit
Charge .... 2.5 grains fulminate of mercury, potassium chlorate, antimony sulfide
Gun used in .... 20-mm Brass Case Mk 2

Percussion Primer Mk 31

Over-all length, inch 0.250
Diameter of body, inch 0.3325
Material .... Brass
Method of securing .... Press-fit
Charge .... 2.10 grains lead sulfocyanate, antimony sulfide, potassium chlorate, pentaerythritol tetranitrate
Gun used in .... 20-mm Steel Case Mk 3 and Brass Case Mk 4; also in Army M21A1 series cases

This primer is the same as the Army Primers M36 and M36A1

Electric Primer Mk 35 Mod 0

Over-all length, inches 23.601
Diameter of body, inch 0.760
Method of securing .... Screwed into case
Charge .... Black powder
Cap .... None. Platinum electric bridge, plus gun cotton and black powder mixture

TRACERS

Mk 5 Mods 0 and 1

Over-all length, inches..................2.48
Diameter of head, inches...............1.248
Starter pyrotechnic....Barium peroxide and magnesium powder
Illuminant......Sodium nitrate, calcium silicide, charcoal, and linseed oil
Color ....Orange

Hot propellant gases burn through the cellu- in turn, ignites the orange illuminant.

Mk 6 Mods 0 and 1

Over-all length, inches..................2.45
Diameter of head, inch................0.939
Starter pyrotechnic.........Barium peroxide and magnesium powder
Illuminant.....Red—strontium nitrate, ammonium perchlorate, magnesium powder, charcoal, and linseed oil
White—barium nitrate, barium peroxide, magnesium powder, aluminum powder, and wax
Colors..............Mod 0—red and white
Mod 1—orange
Projectiles used in
Mod 0—with adapter in 5″/25 A.A. Common Projectiles Mk 28 and 5″/38 A.A. Common Projectiles Mk 31, blind-loaded for target practice
Mod 1—with adapter in 4″/50 Common Projectiles Mk 6 Mod 6 and Mk 10 Mods 1 to 3 and 5″/51 Common Projectiles Mk 15 Mods 5 and 13, blind-loaded for target practice.

Propellant gases burn through the celluloid disc and ignite the starter mixture, which fires the illuminant.

Mk 8 Mod 0 (Obsolete)

Over-all length, inches..................2.12
Diameter of head, inch................0.925
Starter pyrotechnic....Barium peroxide and magnesium powder
Projectiles used in..............40-mm A.A.

Operation: The cap holder, when the shell is fired, sets back, thus overcoming the stirrup spring, and forces itself against the anvil, igniting the tracer and initiating its action, and blowing out the sealing disc abaft the anvil.

Mk 9

Over-all length, inches..................2.48
Diameter of head, inches..............1.248
Starter mixture......Barium peroxide, magnesium powder, barium nitrate
Illuminant....White—aluminum powder and wax
Red—strontium nitrate, ammonium perchlorate, magnesium powder, charcoal, and linseed oil
Projectiles used in..4″/50, 5″/38, and 5″/25

Propellant gases burn through the celluloid disc and ignite the starter, which fires the illuminant

Mk 10 Mod 0 (Obsolete)

Over-all length, inches..................2.9
Diameter of head, inch.................0.93
Starter pyrotechnic
Magnesium powder, barium peroxide, and aluminum
Illuminant......Magnesium powder, strontium nitrate, and ammonium perchlorate

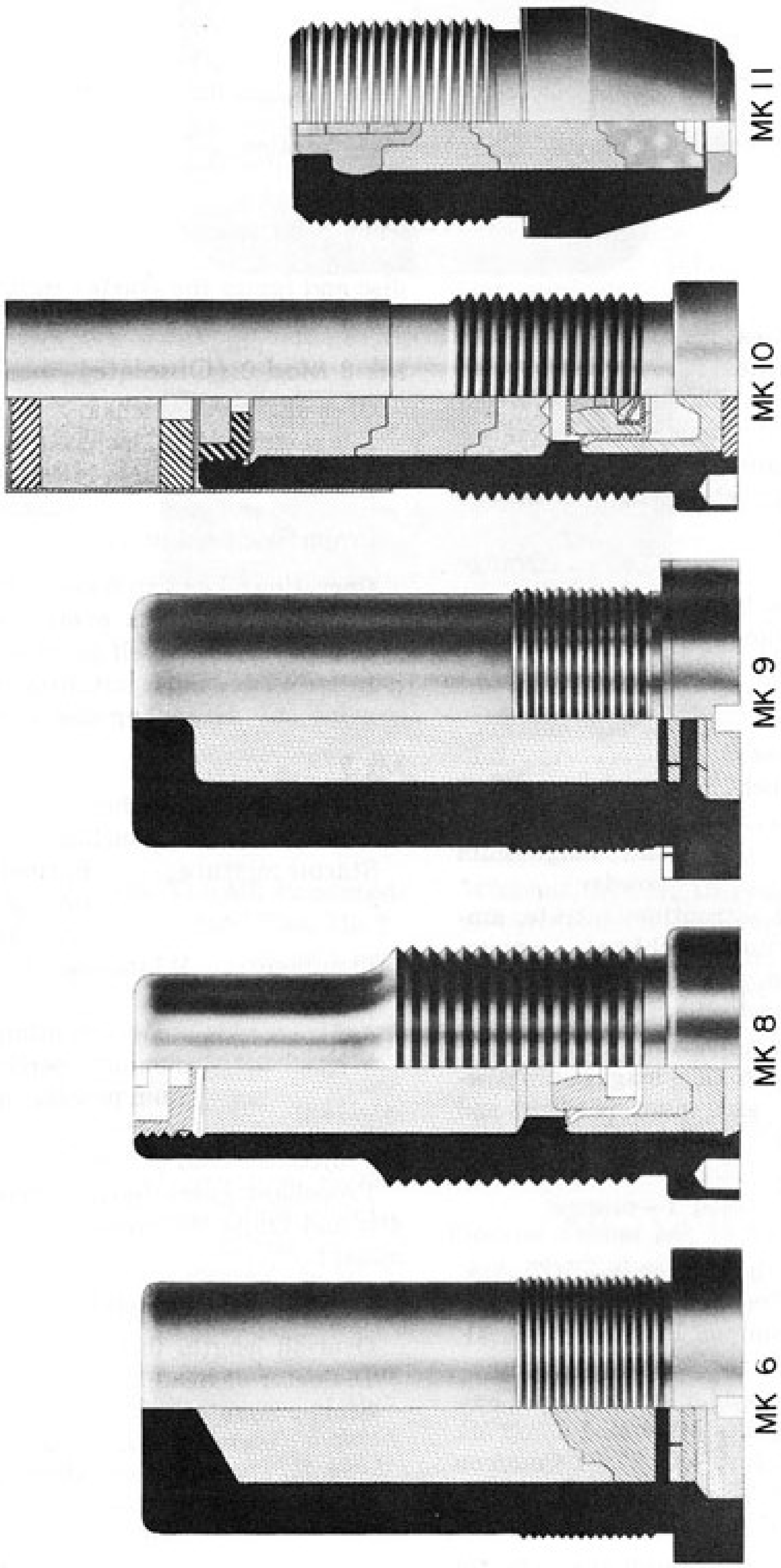


Figure 112. Tracers (not proportionate sizes)

Color ....Red
Projectiles used in....40-mm H.E., H.E.–I., and B.L.

Operation: Set-back forces the primer carrier back, bending the ears on the stirrup spring and bringing the primer against the fixed anvil. The flash from the primer ignites the tracer starter, which initiates the tracer illuminant.

This tracer is self-destroying, containing an igniter pellet of 6 grains of black powder and a 5.7-gram self-destroying black-powder pellet. When the tracer illuminant has burned through, the igniter pellet is fired, initiating the self-destroying element, which, in turn, explodes the projectile.

Remarks: The Tracer Mk 10 is being replaced by the Mk 11 in all assemblies.

Mk 11 Mods 0—3

Overall length, inches..................1.78
Diameter of head, inches......0.925 tapering to 0.65
Starter pyrotechnic....Magnesium powder, barium peroxide, and aluminum
Illuminant......Magnesium powder, strontium nitrate, ammonium perchlorate, charcoal, and wax
Colors ....Red or non-luminous (dark)
Projectiles used in....40-mm H.E., H.E.–I., and B.L.
Ignition method.....Propellant gases heat or burn through the brass closing disc and ignite the starter, which initiates the illuminant

Remarks: The only difference between the various Mods of the Tracer Mk 11 is in the construction of the relay housing:

Mod 0—Housing is threaded.

Mod 2—Housing is a push-fit.

Mod 3—Housing is an integral part of tracer body.

The relay housing contains three black-powder pellets, which are ignited at the end of the burning of the tracer. The pellets, in turn, initiate the main charge of the projectile.

The "dark ignition" loading of the Tracer Mk 11 has the starter pyrotechnic of 65% barium peroxide and 35% powdered silenium. With the substitution of silenium for the magnesium, the tracer does not become visible until some 200 yards from the muzzle. 40-mm ammunition using the "dark ignition" tracer is labeled H.E.–I.–T.–D.I.–S.D.(U.M.).

"Dark" Tracers Mk 11 are non-luminous; hence invisible day or night. They permit time of flight of 8.5 to 10.0 seconds (4,200 to 4,600 yards) before self destruction. A small, intense flash immediately precedes the flash from the bursting projectile. This ammunition was designed for night director-controlled fire. Lots are labeled H.E.I.–S.D.(U.K.).

Mk 14 Mod 0

The Tracer Mk 14 is of the non-self-destroying type. It is made like the Tracer Mk 11, except that, instead of the relay housing, there is only the blanked-off end of the cavity. Only a few of these tracers were ever made.

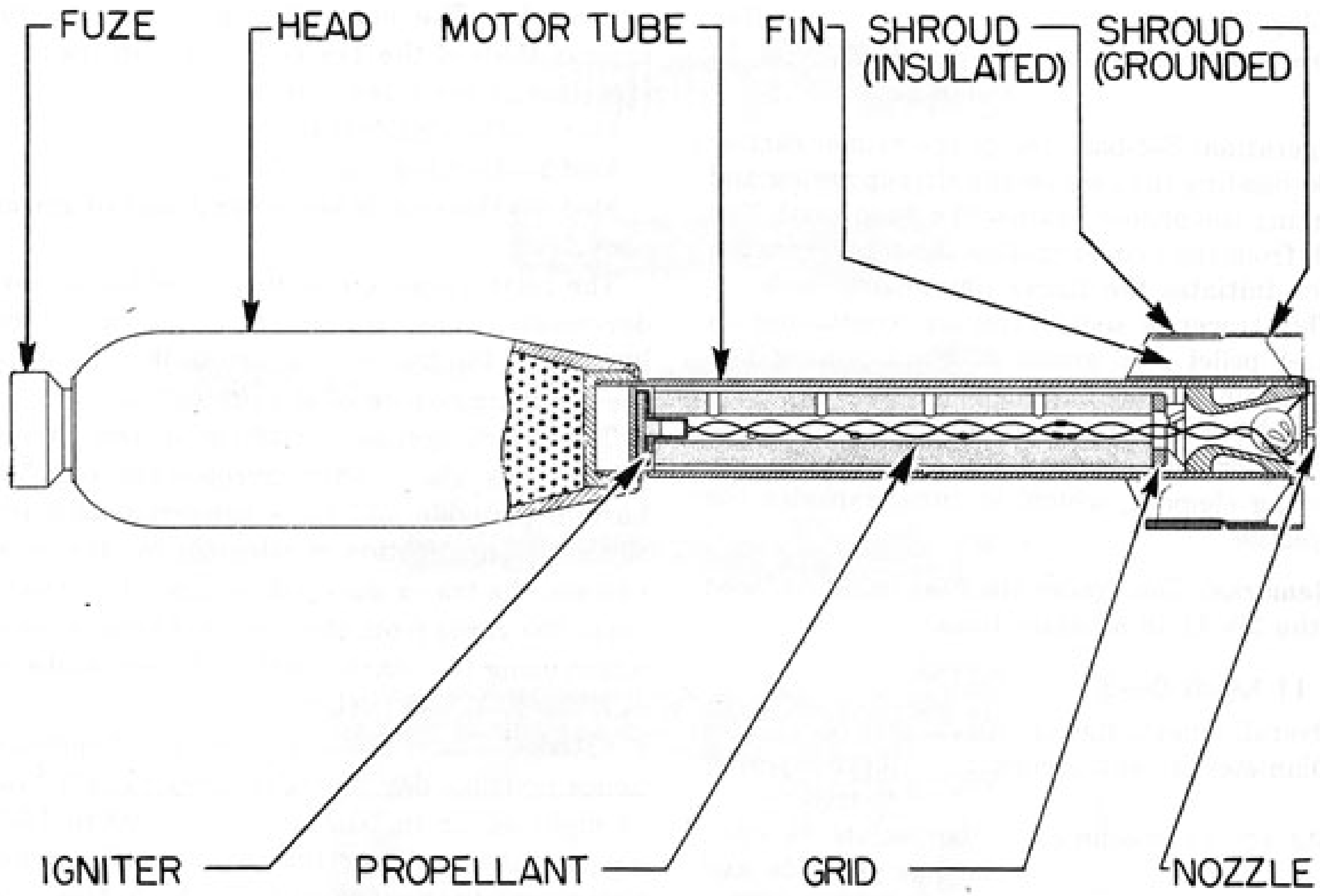


Figure 113. Typical Rocket Components

Abbreviations

The following abbreviations are used in the ensuing chapters:

S.S.—Spin-stabilized
A.R.—Aircraft rocket
H.E.—High explosive
A/T—Anti-tank
D.R.—Demolition rocket
B.R.—Barrage rocket
S.A.P.—Semi-armor-piercing
F.S.—Sulphur trioxide in chlorosulphonic acid
W.P.—White phosphorus
P.W.P.—Plasticized white phosphorus
C.W.R.-N.—Chemical warfare rocket, Navy

Part 2

ROCKETS AND ROCKET FUZES

Chapter 5 — ROCKET BODIES

Section I — INTRODUCTION

General

The propelling unit of the rocket is called the motor and contains the propelling charge. The motor is attached to the head, which contains the payload and the initiating device. The motor is closed on the forward end and partially opened at the after end. The propellant is a relatively slow-burning double-base smokeless powder called ballistite.

As the ballistite is burned, hot gases are generated which expand and exert pressure against the confines of the motor tube. Since the hot gases exert an equal pressure in all directions, the pressures against the side walls counterbalance each other; however, the pressure against the forward closed end of the tube is not counteracted by pressure against the after end, since that end is partially open. The resultant force, then, is a thrust against the closed forward end of the motor, and the rocket is propelled in that direction. In order that the pressure of the gases will not be expended too rapidly, and that the propellant can be retained in flight, the after end of the motor tube is partially closed by the nozzle attachment, which is built into the inside of the tube. This nozzle restricts the ejection of the hot gases and also, by means of its rear taper, furnishes a canted surface against which the rapidly expanding emitted gases may act to increase the forward thrust of the rocket.

The ballistite propellant is ignited by a black-powder charge, the initiating device for which is an electric squib with a small bridge wire of high resistance which, when heated by an electrical current, ignites a violent match composition. The black-powder charge sends a flash over the entire surface of the ballistite and raises the temperature of the ballistite to the ignition point. Upon ignition, the ballistite burns evenly and relatively slowly; this type of burning is necessary to prevent sudden and excessive pressures being exerted against the thin walls of the motor tube. Rocket motors operate at much lower pressures than guns, and correspondingly longer times are required for the complete combustion of the rocket propellant. Burning times of American rockets range from about 0.15 second to as much as 1.5 seconds, depending on the web thickness of the grain and the temperature of the propellant; and burning distances range from a few feet to several hundred feet at high velocities; hence, most of the burning of the rocket propellant occurs after the projectile has left the launcher.

The early productions of rockets were of the fin-stabilized type because of their use by the British and because of the inherent simplicity associated with fin stabilization. Rockets cannot be launched with that degree of accuracy characteristic of gun projectiles. This is a result of many factors, such as the effect of temperature on the burning rate of the propellant, difficulties in controlling to a fine degree the pressures exerted by the expanding gases inside the motor tube, the effect of the expansion of emitted gases against the rear taper of the nozzle, etc. The mean deviation in deflection for most standard land- or shipboard-launched fin-stabilized rockets is 20 to 40 mils, while fin-stabilized rockets launched from aircraft have a mean deviation of about 5 to 10 mils. The increased

accuracy of aircraft-launched rockets is attributed to the immediate stabilizing effect given to the fins during the initial stages of flight by the rapid travel of the plane through the air. Fins on rockets exert an appreciable restoring force in flight only at a high velocity, and thus a greater degree of accuracy is achieved if rockets are launched from aircraft or if the acceleration occurs to a large extent on the launcher.

A later development, the spin-stabilized rocket, is now in service use. Stabilization of this rocket depends on the rotation of the round. Although the accuracy of spin-stabilized rockets is not comparable to that of gun projectiles, they are generally more accurate than fin-stabilized rockets at short ranges. The use of spin-stabilized rockets will be particularly advantageous to ground and amphibious forces, inasmuch as the rocket is shorter and the launching gear is more compact, facts which facilitate the loading and stowage problems.

As against their disadvantages, rockets have many advantages over gun-propelled projectiles. The most important is the absence of recoil against the launcher. Since there is no recoil action on the launcher, rockets may be launched from small trucks, amphibious ships, and aircraft which could not withstand the recoil forces exerted by equivalent projectiles fired from guns. Other advantages of rockets are cheapness, simplicity, and portability of the launchers as compared to guns.

Components

Head: This is the part which is functionally similar to a projectile and which contains the payload and the initiating device. This payload may be solid shot, high explosive, chemical, incendiary, window, flare, or a special load.

Motor tube: This contains the propelling charge and the igniter. It is a combustion chamber in which the propellant is burned to provide the motive power for the rocket. It generally threads to the rocket head and is usually shipped separate from the head and fuze. The diameter of the motor is generally less than the diameter of the body with which it is used.

Grid or trap assembly: The Navy refers to the assembly which supports the powder grain as the **grid.** This grid supports the grain in such a position that sufficient clearance is allowed between the grain and the motor tube to allow the gas to flow from the propellant to the nozzle. The Army uses a trap assembly, which is somewhat more complicated than the Navy grid. The trap assembly consists of spacing discs and wires running between them, on which the sticks of ballistite are supported. Such an assembly is necessary where numerous small grains are used.

Nozzle: The number of nozzles varies with the type of motor and method of stabilization. The nozzle has several functions. It directs the gas jet in the desired direction and provides for expansion of the hot gas in the exit cone, thus giving additional thrust (about 33%) over that obtainable from a simple orifice. In spin-stabilized rockets, it imparts a clockwise rotatoin to the rocket when launched.

Fins: During burning, the action of the air against the fins gives a restoring moment against side forces at the nozzle, thus improving the accuracy of fire. When there is a tail shroud, it supports the rear end of the rocket in the launcher and may also provide electrical contacts for firing.

Propellant and igniter: The igniter contains loosely packed black powder and an electric squib with a high-resistance bridge running through a match composition. The propellant is a double-base smokeless powder called ballistite, which burns slowly and uniformly. Production of ballistite differs somewhat for the Army and the Navy, the Army preferring the solvent extrusion process and the Navy specifying the solventless extrusion process. The solvent extrusion process is impracticable for grains having a web of more than 1-1/4 inches.

Grain shapes also vary. Army rockets generally have several small cylindrical grains of ballistite, with an axial hole to increase the burning surface and uniformity of burning. The Navy rockets use either a single solid cruciform

grain without perforations or a single cylindrical grain with an axial hole and radial perforations. The latter, used in Navy ground- or shipboard-mounted rockets, is characterized by three ridges 120° removed and running longitudinally along the grain. Inhibitors are not used on this type. The cruciform grain, in Navy aircraft rockets, is a symmetrical cross with rounded ends. If all the exterior surface of this grain were permitted to burn, there would be a gradual decrease of area, and a regressive rate in burning. Hence, a number of slower burning cellulose acetate strips are bonded to parts of the area exposed on the outer curved ends of the arms, to give desired burning characteristics.

Storage

To decrease hazards in handling, rocket bodies and motors are generally shipped and stored separately. Motors with large grains are kept in a non-propulsive state until final assembly is necessary. The seals at both ends of the motors are light and easily displaced by pressure developed inside the tube. Should the igniter and grain ignite, the closures would fail quickly, relieving the pressure without more than a slight movement of the motor.

It is necessary that loaded motors be kept at moderate temperatures as much as possible. Even though spontaneous ignition should not take place, the powder should not be stored where temperatures exceed 100° F, because such conditions tend markedly to decrease the stable life of the propellant. Because of the electric squib, rocket motors should not be stored near radio apparatus or antenna leads.

Although there is very little possibility of a motor firing as a result of falling or rough handling, such treatment is likely to cause malfunctioning of the rounds. Ammunition should be kept in packing containers or ready boxes and should not be handled in a loose condition unless necessary.

Practice rockets

Practice rockets are loaded with plaster of paris or other inert substances to simulate the explosive loads in service rounds. These rockets also have dummy fuzes.

Safe temperatures

The burning rate of propellent powders changes with temperature and pressure—the higher temperatures and pressures causing more rapid burning. If rockets are fired at temperatures higher than those for which they are designed, the pressure may build up faster than the nozzle can release it, perhaps bursting the round. At temperatures below the safety limit, there will be back blasts of flame with burning fragments of powder.

Retro rockets

These were rockets designed to be fired aft from a fast moving ship or plane—the movement aft to compensate exactly for the movement forward of the launching vehicle, thus leaving gravity as the only effective force on the rocket.

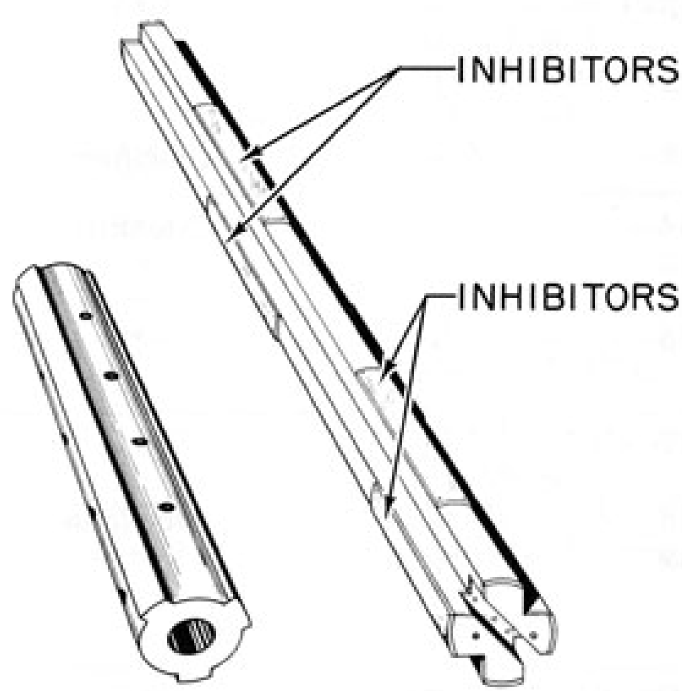


Figure 114. Rocket Propellent Grains

Mark	Mod	Shape	Cruciform U.S. Navy Thickness (inches)	Cruciform Outside Diameter (inches)	Outside Diameter (inches)
1	–	Cylindrical	–	–	1.97
2	–	"	–	–	1.97
3	–	"	–	–	1.97
3	1	"	–	–	1.97
4	–	"	–	–	1.10
4	1	"	–	–	1.10
5	–	"	–	–	1.10
5	1	"	–	–	1.10
6	–	"	–	–	2.95
6	1	"	–	–	2.96
7	–	"	–	–	2.96
7	1	"	–	–	2.96
8	–	"	–	–	2.96
8	1	"	–	–	2.96
9	–	"	–	–	2.96
10	–	"	–	–	1.97
11	–	"	–	–	2.96
11	1	"	–	–	2.96
12	–	"	–	–	1.10
12	1	"	–	–	1.10
13	–	Cruciform	0.990	2.930	–
14	–	Cylindrical	–	–	2.96
15	–	"	–	–	2.96
16	–	"	–	–	1.97
16	1	"	–	–	1.97
17	–	"	–	–	1.97
18	0	Cruciform	1.540	4.530	–
19	0	"	1.540	4.530	–
20	0	"	0.990	2.93	–
21	0	"	1.540	4.53	–
22	0	"	1.540	4.53	–
23	0	"	0.990	2.93	–
24	0	"			
25	0	"			

Cylindrical Inside Diameter (inches)	Body Diameter (inches)	Weight (pounds)	Length (inches)	Motors Used In
0.59	1.70	1.429	11.60	2.25″ R.M. Mks 1. 3, 7, 8, and 9
0.43	1.70	1.551	11.60	2.25″ R.M. Mk 3
0.51	1.72	1.503	11.60	2.25″ R.M. Mk 3
0.51	1.70	1.503	11.60	2.25″ R.M. Mk 3
0.50	0.99	0.207	5.80	
0.53	0.99	0.207	6.10	
0.50	0.99	0.142	4.10	
0.53	0.99	0.142	4.40	
1.41	2.49	1.800	8.06	3.25″ R.M. Mk 1
1.42	2.51	1.800	8.70	3.25″ R.M. Mk 1
1.38	2.49	2.800	13.00	3.25″ R.M. Mk 2
1.37	2.51	2.800	13.00	3.25″ R.M. Mk 2
1.38	2.49	4.140	19.30	3.25″ R.M. Mk 3
1.37	2.51	4.140	19.55	3.25″ R.M. Mk 3
1.42	2.51	1.690	8.15	3.25″ R.M. Mk 4
1.63	1.70	1.397	11.50	2.25″ R.M. Mk 5
1.05	2.55	5.250	20.25	3.25″ R.M. Mk 5
1.03	2.55	5.250	20.25	3.25″ R.M. Mk 5
0.53	0.99	0.298	8.300	1.25″ R.M. Mk 4 and Mk 4 Mod 1
0.53	0.99	0.298	8.800	1.25″ R.M. Mk 4 and Mk 4 Mod 1
–	–	8.83	34.000	3.25″ Mk 7 (Aircraft)
1.03	2.55	3.77	14.600	Rocket Mk 10 (Target)
1.03	2.55	2.60	10.100	Rocket Mk 11
0.26	1.70	1.75	13.287	2.25″ Mk 10
0.26	1.66	1.75	14.037	2.25″ Mk 10, Mk 10–1, Mk 11 and Mods
0.26	1.66	1.12	9.250	2.25″ Mk 12, Mk 13 and Mods
–	–	24.83	39.750	5.0″ Mk 1, Mk 1
–	–	38.00	59.750	11.75″ Mk 1.4 grains required for one assembly
–	–	8.83	34.000	3.25″ Mk 7 (Aircraft)
–	–	10.38	16.750	5.0″ Mk 3 (H.V.S.R.)
–	–	5.83	9.350	5.0″ Mk 4 (H.C.S.R.)
–	–	2.50	9.950	3.50″ S.S. Mk 13 5.0″ S.S. Mk 5 5.0″ S.S. Mk 6

ARMY ROCKETS (SERVICE TYPES)

2.36-inch A/T

Service—M6A1, M6A3, M6A4, M6A5
Practice—M7A1, M7A3, M7A4, M7A6

	M6A1 and M6A3
Over-all length, inches	21.6
Total weight, pounds	M6A1, 3.4 M6A3, 19.4
Head length, inches	8.6
Body length, inches	4.11
Body diameter, inches	2.23
Body wall thickness, inch	0.087
Ogive length, inches	
M6A1 (cone shaped)	4.5
M6A3 (hemispherical)	4.56
Ogive diameter (at flange), inches	2.245
Motor tube length, inches	6.32
Motor tube (inner diameter), inches	1.06
Motor tube wall thickness, inch	0.095
Maximum range, yards	700
Effective range, yards	300
Muzzle velocity, ft./sec.	265
Color	Olive drab
Explosive	Pentolite

General: Pill boxes, tanks, and armored vehicles are prime targets. The rocket can also be used in a stationary emplacement for demolition or as an anti-tank mine or a booby trap. The rocket can penetrate three inches of homogeneous-steel armor plate at all ranges and at angles of impact as low as 30 degrees, employing the shaped-charge explosive.

Launcher: The Rocket Launcher M1A1, commonly called the "bazooka", is an electrically operated weapon of the open-tube type, fired from the shoulder, and weighing 13.26 pounds. Rocket Launcher M9A1 is similar but breaks down into two sections, each 31 inches long, for ease in transporting.

Construction: The 2.36-inch A/T Rockets M6A1 and M6A3 are identical except for difference in the ogive and the tail assembly. In other respects the two rockets are similar, consisting of a hollow ogive crimped onto the body, a body union fitting into the base of the body with internal threads to receive the motor, and a fuze which is located in the forward end of the motor tube. The M6A1 has a conical ogive, whereas the M6A3 has a hemispherical ogive which gives better penetration by forming a stronger standoff piece for the shaped-charge effect of the explosive. M6A4 is like the M6A3, except that it is lighter—being made of high-strength alloys—and also uses the Bore-Safe Fuze M400. The M6A5 uses the Bore-Safe Fuze M401 and has a larger propellant grain, which eliminates the safety disk.

Tail assembly: The M6A1 has six fins (5½ inches long) spot-welded to the nozzle, a steel cup internally threaded at the forward end to screw onto the motor tube. The M6A3 has a different type of tail assembly to obtain fin area and counteract the change of the center of gravity effected by the hemispherical nose. This tail assembly consists of four sheet-steel fins 2-5/16 inches long, each of which is curved over an arc of 90 degrees on its outboard edge to form a blade. Each fin is joined to the other by welding, with an overlap of approximately ½ inch to form a circular drum which is actually nothing more than a continuation of the four fins. The bases of the fins are spot-welded to the nozzle. In the M6A5 and M7A6 the free end of the ignition wire is attached to the shroud tail by a chip-board disk, instead of the tape on earlier models.

Propellant: The propellant consists of five sticks of ballistite. On an average, the propel-

lant weighs approximately 61½ grams, though it is loaded not by weight but rather by length of powder stick, to keep the pressure for various rounds at a relatively constant value. The M6A4 and M6A5 use the Powder M7, which burns at a lower temperature, +120° to −40° F.

Fuze: The fuze for the M6A1 and M6A3 consists of a steel firing pin which slips into the central cavity of the fuze body, where it is held in a rearward position by the firing-pin spring. A circumferential groove midway down the length of the firing pin receives the safety pin, which extends through the motor tube. When the safety pin is removed, the firing pin is free to move forward, restrained only by the action of the firing-pin spring. After the safety pin has been removed, the firing pin will overcome the spring and detonate the rocket if it is dropped over four feet. The fuze body contains the Detonator M18 of lead azide and tetryl, and the booster charge of tetryl.

Remarks: The practice rounds are similar to their accompanying service rounds, except that they are inert-loaded and have a dummy fuze or steel weight to fill the empty fuze space.

The M6A5 and M7A6 have plastic closing plugs, making them waterproof rounds. They also use the Powder M7, which burns at a lower temperature, +120° to −40° F.

The M6A1 and M7A1 are now considered obsolete.

2.36-inch Smoke (W.P.) M10, M10A1, M10A2, M10A3

	M10
Over-all length, inches	17.1
Total weight, pounds	3.4
Length of head, inches	5½
Maximum diameter, inches	2.36
Diameter of head, inches	2.30
W.P. charge, grams	405
Burster charge, grams	4
Effective range, yards	300
Color	Motor—olive drab Head—blue grey

General: This rocket is designed not only as a screening agent, but also to cause casualties.

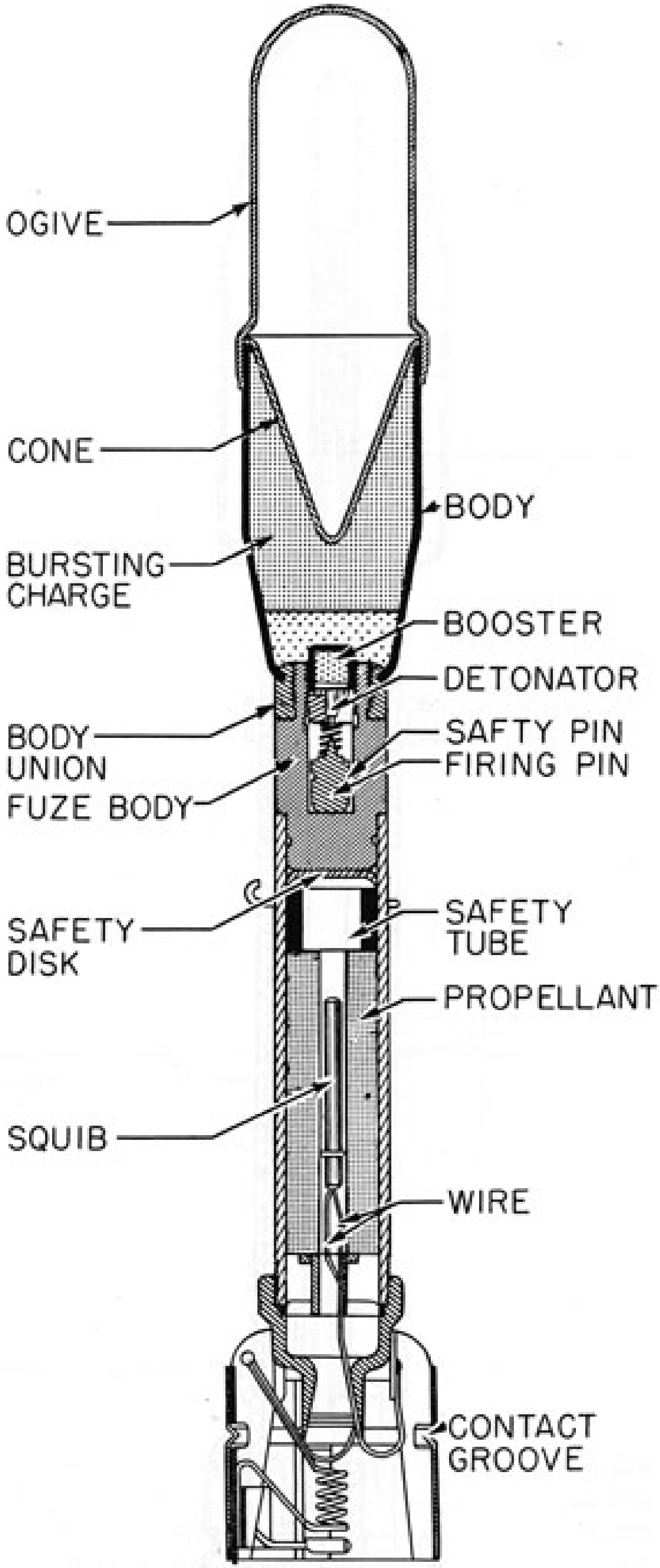


Figure 115. 2.36-inch A/T Rocket M6A1

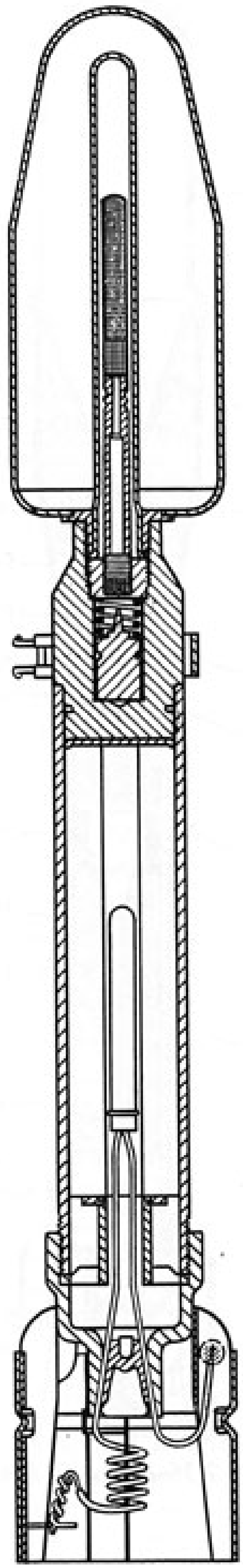


Figure 116. 2.36–inch Smoke Rocket M10A1

White phosphorus in smoke form has little effect upon the human body, but particles cause small burns. This rocket makes an effective weapon for dislodging enemy troops from dugouts and foxholes.

Launcher: The 2.36-inch Smoke Rocket M10 is fired from the Launcher M1A1 or M9, the "bazooka."

Construction: The components of this rocket are the motor and the head assembly. The motor presently used is the M6A1, which is being replaced by the M6A3. As new motors are developed, it is contemplated that this rocket will be modified.

The head assembly consists of a container for the smoke charge with a long burster well containing PETN inserted from its after end. A collar is soldered to the base of the container. The spacer slips over the threads of the collar and is held against the flat surfaces of the collar by the fuze body, forming a joint between the two. The primer holder is threaded into the fuze body.

Tail assembly: The 2.36-inch Smoke Rocket M10 has the standard tail assembly for the M6A1 or M6A3 motors.

Fuzing: The fuze is similar to that used in the A/T Rocket M6A3.

Remarks: The M10A1 and M10A2 differ from the M10 in the type of propellant used. The M10A1 used the T1E1 Salted Powder, with a temperature range of 120° to −20° F. The M10A2 uses the Powder M7, 120° to −40° F. The M10A3 differs from the M10A2 in that it uses the Fuze M401.

2.36-inch Gas M26

Over-all length, inches 17.66

Except for its increased length, the 2.36-inch Gas Rocket M26 is structurally the same as the 2.36-inch M10A2. The M26 is filled with C.K. (phosgene) gas.

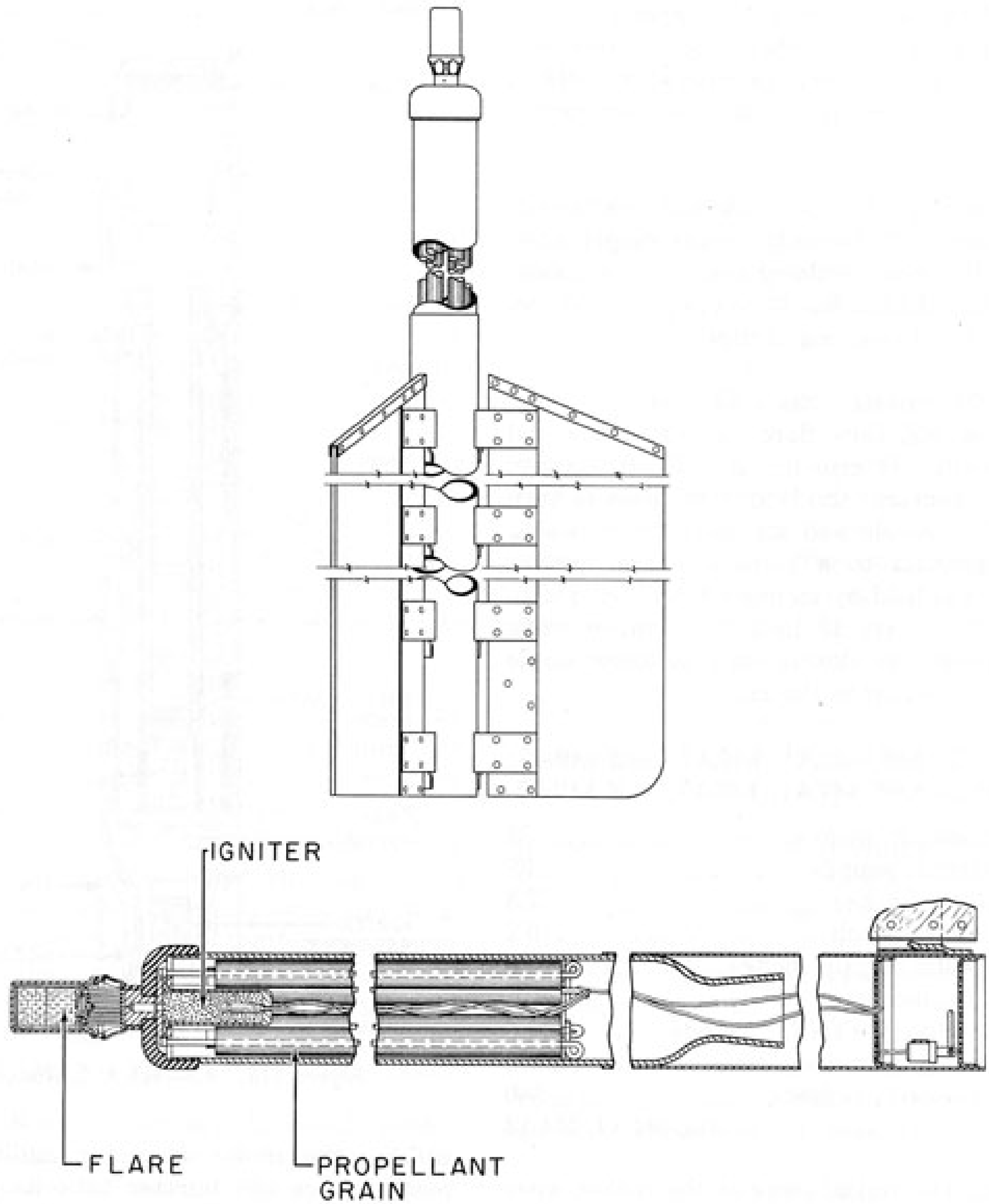


Figure 117. 3.25–inch Target Rocket M2A2

3.25-inch Target M2, M2A1, M2A2

Over-all length, inches 59
Width across fins, inches 24
Weight, pounds 37.5
Propellant weight, pounds 3.2
Range, yards 1,700
Maximum velocity, ft./sec. 530
Burning time of flare, seconds 30

General: This is a high-speed target for firing

practice with automatic A.A. weapons.

Propellant: The propellant has grains five inches long and 7/8-inch in diameter, with a 5/16-inch axial hole. It is ignited by an electric squib.

M2A1: When a flare is added to the 3.25-inch Target Rocket M2 for antiaircraft target practice at night, the resulting projectile is designated as the M2A1. The flare burns for 30 seconds from the beginning of flight.

M2A2: This design has a flat nose, to which is threaded a yellow flare for both day and night tracking. It also has a different system for igniter contact: the lead wires pass in turn through the nozzle and an inner fiber closing cup and connect to a household-type service plug, which is held by an outer fiber-board closing cup. There are 18 inches of igniter cable coiled between the closing cups, to allow ample lead for connecting to the launcher.

4.5-inch H.E. M8, M8A1, M8A2, and M8A3; also Practice M9, M9A1, M9A2, and M9A3

Over-all length, inches	33
Total weight, pounds	38
Head length, inches	7.5
Wall thickness, inch	0.2
Burster tube length, inches	15.5
Fin length, inches	4 1/8
Bursting charge (TNT), pounds	4.3
Maximum range, yards	4,500
Muzzle velocity, ft./sec.	840
Fuzing	M4, M4A1, M4A2

General: The initial issue of the rocket went to the Army Air Forces for projection from aircraft launchers against ground targets; but, inasmuch as the rocket was originally designed for use from ground launchers, its use in aircraft has been discontinued.

Construction: The head is a thin-walled high-capacity type, rounded at the nose to form the ogive, threaded at the nose to take the fuze adapter, and threaded externally aft to fit into the motor. A burster tube is fitted to the head and extends down into the motor, a design which utilizes the motor tube for additional fragments, since the burster tube as well as the head itself is loaded with TNT.

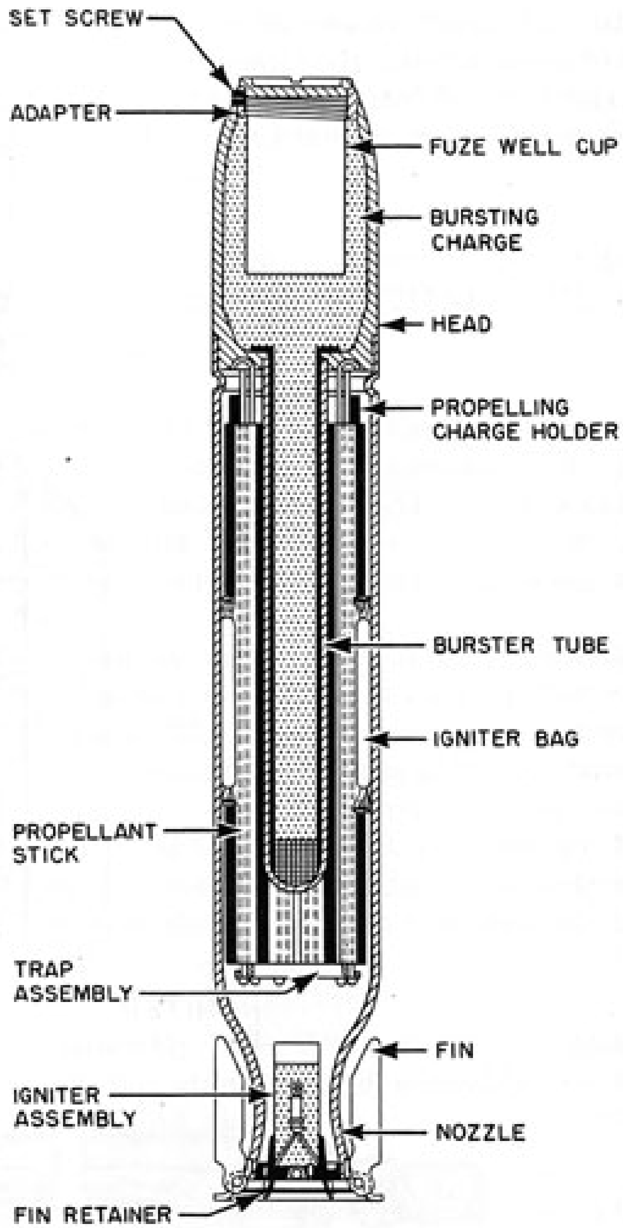


Figure 118. 4.5-inch H.E. Rocket M8

The motor is a steel tube of uniform diameter except at the after end, where it constricts and then flares to form the nozzle. The motor houses the trap assembly, which consists of ten wires running from the trap plate on the forward end to the trap ring on the after end. The trap assembly holds the thirty sticks of propellant and fits around the burster tube. The motor tube is threaded internally forward to take the head, and just abaft this thread is a groove which weakens the tube to provide a

safety shear point, should the motor pressure become too great.

The fin assembly for the rocket opens and guides the rocket in flight only after the rocket has cleared the launcher. The fins of the assembly are held in place by the fin retainer, which is expelled by the blast of the escaping gas. After clearing the launcher, the fins snap to their outstretched position. There are six fins.

The M8A1 involved a change in the design of the motor tube to strengthen it on the threaded end. The head of the M8 was used by machining new base threads. Tests on the M8A1 indicated that the base of the modified head was weak, and a new head was designed for use with the motor of the M8A1. This rocket, the M8A2, will supersede the M8 and M8A1. The M8A3 is a modification of the M8A2 made by the addition of a locking burr to each fin blade to assist in rigidly maintaining the fin in full open position during flight.

Propellant: The propellant consists of 30 sticks of ballistite. Each stick is five inches long and 7/8 inch in diameter with a 1/4-inch axial hole. Three sticks are placed on each trap wire, and there is sufficient clearance between the sticks and the wire to allow burning of the inner stick wall simultaneously with the burning of the outer wall. Two igniter-bag assemblies are bound on two opposite columns of the propellant. The bags assist the ignition of the propellant by catching the flame of the igniter and, in turn, igniting the upper propellant sticks.

Practice Rockets M9, M9A1, M9A2, M9A3: These rockets are similar in design and construction to the M8 series, lacking only the explosive charge and live fuze. The Fuze M4 and booster may be assembled and used in the M9 as a spotting charge.

4.5-inch H.E. S.S. M16, M16E1, and M16E2; also Practice M17, M17E1, and M17E2; also M20 and M21

	M16
Over-all length, inches	31
Total weight, pounds	42.5
Head length (with burster tube), inches	23.29
TNT charge, pounds	4.3
Range, yards	5,250
Maximum velocity, ft./sec.	830
Fuzing	M81

Description: The head, loaded with high explosive, contains a fuze-well cup and a burster tube. The burster tube projects about 15 inches into the center of the rocket motor to secure additional fragmentation. The motor body is a steel tube threaded at each end to receive the head and the nozzle plate, which contains eight nozzles equally spaced in a circle and one nozzle in the center. The eight nozzles are set at an angle in order to impart rotation to the round when fired. The center nozzle is normally closed by a blowout disc which is designed to fail when the internal pressure in the body surpasses a predetermined limit. The nozzle openings are protected by a plastic sealing disc which remains in place during firing and is blown out by the rocket blast.

Propellant: The propelling charge consists of 30 grains of ballistite strung on wires of a cage-like trap. The igniter consists of a charge of black powder enclosed in a plastic tube attached to the trap and running the length of the charge. The tube also contains an electric squib. The leads of the squib pass through one of the nozzles, one lead being grounded to the motor body and the other connected to a contact ring.

M20: The M20 is similar in design and construction to the M16, differing only in that the ignition wires are attached to spools rather than contact rings.

Practice Rockets M17 and M21: These are similar in design and construction to the H.E. rounds, but lack the explosive charge and the live fuze.

The M16E1 has a deeper fuze cavity for the V.T. Fuze M402 (Mk 173). Shipped with these rockets is a supplementary charge to fill part of this cavity in case the Fuzes M81 or M48A2 are used.

The M16E2 is like the M16E1, except that purge pellets of 411E composition have been added to eliminate chunks in burning.

5-inch A.R.

The Army is currently using the Navy-designed 5-inch aircraft rockets. See Section 4 of this chapter.

7.2-inch Chemical M25 and M27

In the 7.2-inch size, the Army has standardized the chemical round designed by the Navy. See Navy chemical warfare rocket, pages 178 and 179.

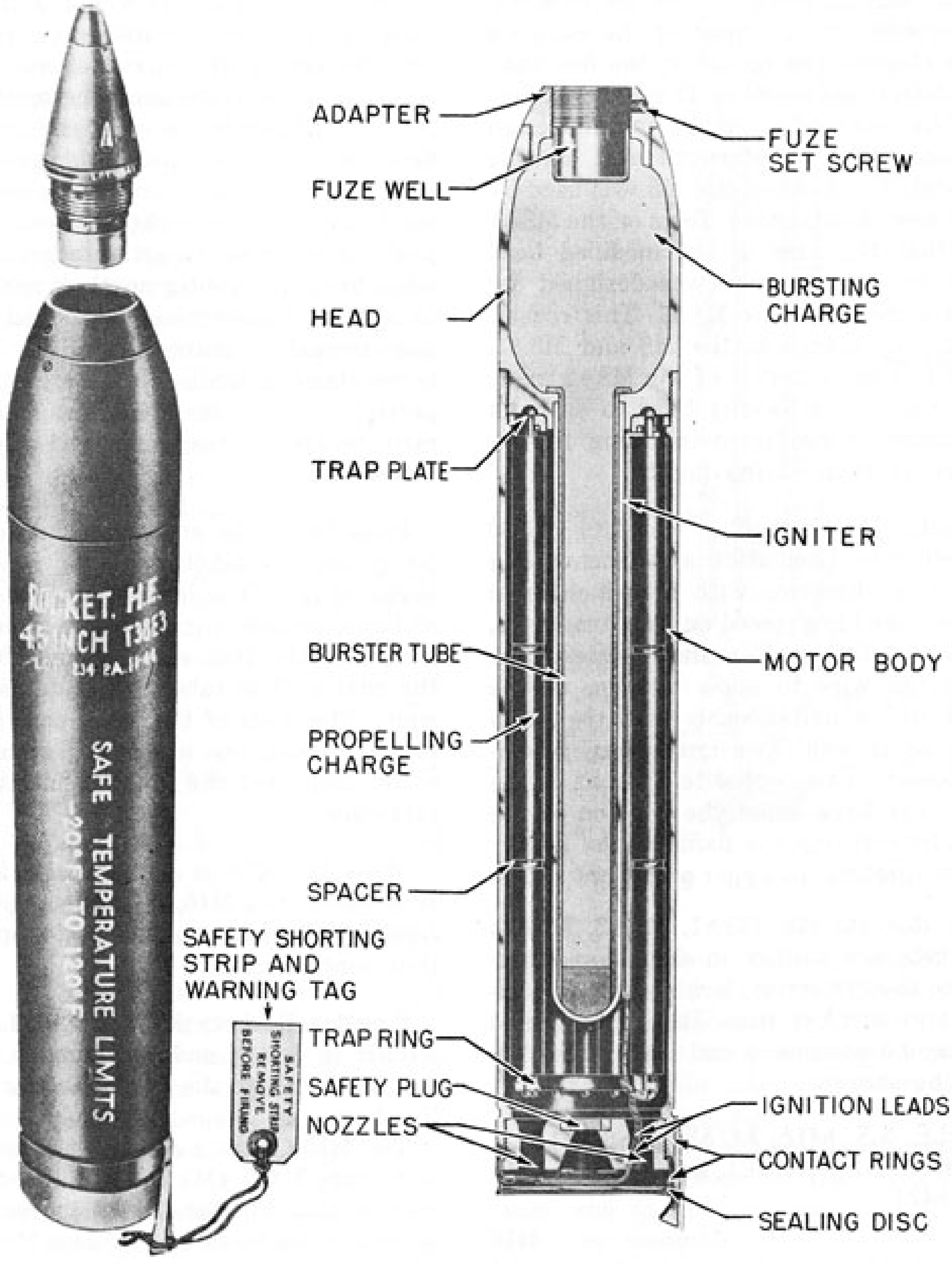


Figure 119. 4.5-inch H.E. S.S. Rocket M16

SOME ARMY DEVELOPMENTAL TYPES

2.36-inch Smoke T–27E1

Over-all length, inches	16.1
Total weight, pounds	3.4
Length of head, inches	4.5
H.C. smoke charge, pound	1.0

General: This rocket is generally similar to the other smoke rockets in this series, differing mainly in its payload. It also differs in that it has a circle of smoke ports in the base of the head, which allow the H.C. smoke to be blown out of the head on impact. Pressure of the H.C. smoke blows out the port covers after the base fuze sets off the H.C. gas. The H.C. smoke will issue for one minute after impact.

2.36-inch Incendiary T31

Over-all length, inches	17.7
Total weight, pounds	3.4
Length of head, inches	4.1
Thermite filler, pounds	1.1

General: The T31 is like the other 2.36-inch chemical load rockets, using the same motor and fuzing as the M10. It has, however, a much shorter head. On impact, it ignites and burns, producing extreme heat. It is currently issued for practice only.

4.5-inch H.E. S.S. T22 and Practice T46

General: These rockets have the heavier shell of the M8A2 and M9A2. Also, the motor tube is further strengthened and the assembly of the fins slightly changed. The igniter is loaded in a tube attached to the trap, extending the length of the propellant charge. Its safe temperature range: $-20°$ to $+120°$ F.

3.5-inch A/T T80 and Practice T85

Over-all length, inches	26.3
Weight of head, pounds	5.11

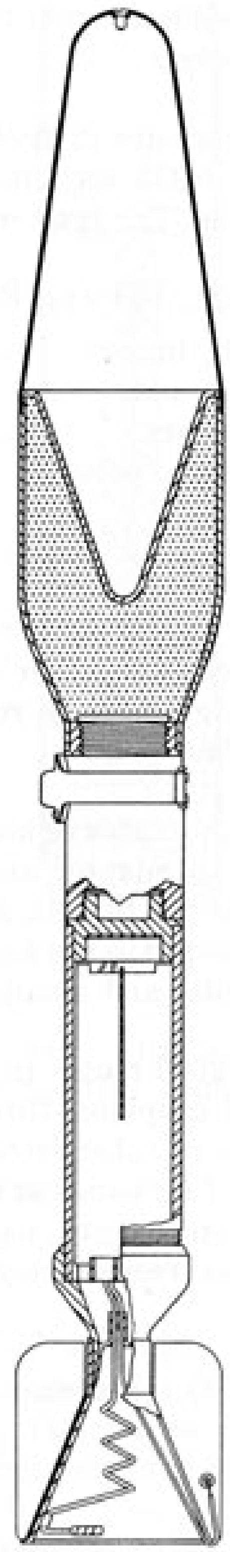


Figure 120. 3.5–inch A/T Rocket T80

65/35 Cyclotal charge, pounds..........1.82
Length of motor, inches...............15.6
Fuzing T160E1

General: This design is mainly a larger type of the 2.36-inch A/T model, with improvements. It has the shaped-charge explosive for penetration. It also has a more efficient propellant and an all-ways-action fuze. Performance tests are still being conducted. It is the largest of the shoulder-fired rockets.

Propellant: There are 12 sticks of powder five inches long and 0.375 inch in diameter; total weight, 160 grams. The igniter is conventional.

4.5-inch H.E.–A.R. T83 and Practice T87

Over-all length, inches................75.88
Total weight, pounds....................98
Head length, inches...................16.68
Weight of charge, pounds..............8.8
Range, yards 1,500
Fuzing ....Mk 149

General: This is one of the "fixed-fin" type of 4.5-inch rockets, the other being the S.A.P. round. It is a high-velocity rocket, fired from the zero-length launchers.

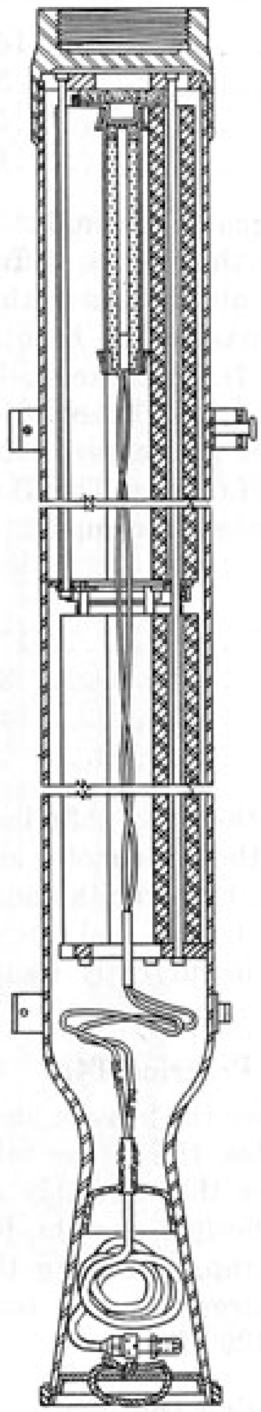
Head: The high-explosive head T2002 is thin-walled and has an adapter and fuze-seat liner for the Nose Fuze Mk 149. An Auxiliary Booster Mk 3 Mod 1 is shipped in the fuze seat, protected by a chipboard disc and a shipping plug.

Motor: The T2000 motor is connected to the head by a steel coupling, threaded internally. The motor tube is constricted at the rear to form the nozzle. Lug bands are one button-type band and one zero-length band, 45.53 inches and 10.25 inches respectively from the base of the rocket.

Tail: The T2000 tail assembly—four flat fins mounted radially on a metal sleeve—is secured to the nozzle by a threaded retainer coupling.

Propellant: Twelve single-perforated sticks of powder having 7/16 inches inside diameter and 1.22 inches outside diameter, 20.6 inches long, are mounted in two banks of six each on the bars of a cage-like support.

Igniter: An electric squib and 2-3/4 ounces of black powder are assembled in a plastic tube 6-3/4 inches long and one inch in diameter. This tube is suspended from the end of the propel-



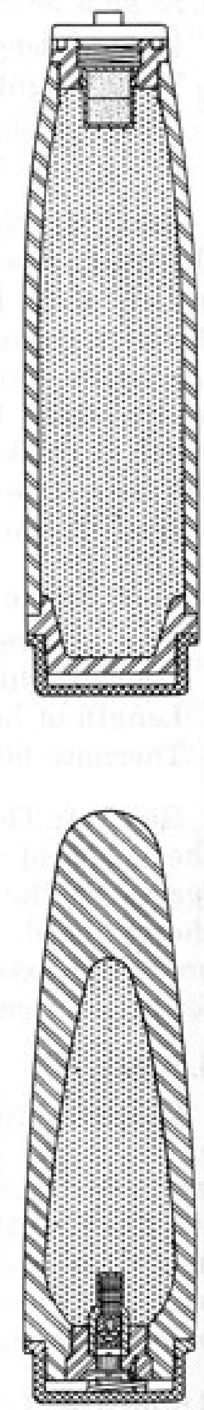


Figure 121. 4.5-inch A.R. —H.E. T83 (above) and S.A.P. T78 (below)

lant in the center of the tube. The ignition wires pass to the rear through a plastic closing cap cemented in the throat of the nozzle. They terminate in a phone-type plug. About two feet of igniter cable are held in the flare of the nozzle by a fiber cap cemented in place.

Practice round: The T87—T2003 head and T2000 motor—is like the T83 except for the live fuze and explosives, for which inert substitutes are provided.

4.5-inch S.A.P.–A.R. T78 and Practice T86

Over-all length, inches	70.89
Total weight, pounds	98
Head length, inches	15.0
Weight of charge, pounds	2.8
Range, yards	1,500
Fuzing	T156

General: This is another "fixed-fin" 4.5-inch rocket. A high-velocity aircraft rocket, it is fired from the zero-length launchers.

Head: This S.A.P. Head T2000 is of heavy-walled construction and threaded at the base to receive the motor tube.

Motor: This round uses the same motor and fin assembly as are found on the T83 round. It also uses the same propellant and igniter. The Practice Round T86, T2001 Head, is inert fuzed and loaded.

4.5-inch H.E. S.S. T160 and Practice T161

Over-all length	
Without fuze, inches	30.07
TNT charge, pounds	6.0
Fuzing	M81 or M402 (V.T.)

General: Because of its more efficient propellant, this round is expected to be a more powerful, longer-range rocket. Except for the propellant, it is of conventional Army design.

Propellant: Seven cylindrical powder sticks, 13.5 inches long and 1.35 inches in diameter, furnish the power. The grid type of support is used instead of the conventional trap, and the igniter is housed against the motor wall, instead of being placed in the center. Safe temperature limits for this round are from −20° F. to +120° F.

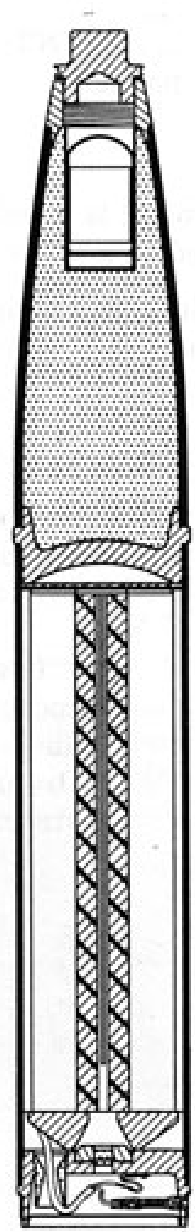


Figure 122. 4.5-inch H.E. S.S. Rocket T160

7.2-inch H.E. T24

See Navy 7.2-inch chemical warfare rocket, p. 178.

7.2-inch D.R. T37 and T88

See Navy 7.2-inch demolition rocket, p. 176.

8-inch D.R. T25

Over-all length, inches	60.25
Total weight, pounds	137
Head length, inches	27.5

Filler .... TNT or 50/50 Amatol
Weight of filler, pounds 58
Range, yards 550
Fuze T20

General: This round is a modified 100-pound G.P. bomb fastened to a 4.5-inch rocket motor.

Construction: Suspension lugs and base plug are removed from the standard 100-pound bomb, and a motor adapter substituted for the base plug. The motor is the standard type for the 4.5-inch Army folding-fin type of rocket, modified to take the special box-type fin. The fuze seat in the bomb is modified to receive the Point Detonating Fuze T20.

Launcher: The metal crate in which the round is shipped serves as an expendable launcher.

H.E. S.S. 21-cm T 36 and Practice T45

Over-all length, inches 48.86
Weight, pounds 91.75
Fuzing M51 (M81)

General: This round is a copy of the German rocket of the same type. At present, performance tests are being conducted by the Army Ordnance Department. It is of conventional structure, with the artillery-type fuze.

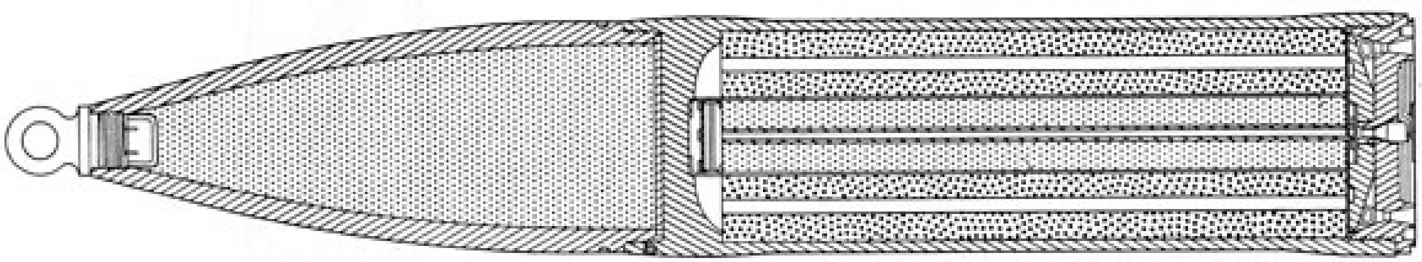


Figure 123. 21–cm H.E. S.S. Rocket T36

NAVY ROCKETS

2.25-INCH ASSEMBLIES

Motor	Head	Velocity	Approximate Trajectory of
2.25″ Mk 10 or 11	2.25″ Mk 1 or 3 (1.6 lb.)	1150 ft./sec.	3.5″ Rocket (3.25″ Motor)
2.25″ Mk 12 or 13	2.25″ Mk 1 or 3 (1.6 lb.)	810 ft./sec.	5.0″ Rocket (3.25″ Motor)
2.25″ Mk 10 or 11	2.25″ Mk 2 (8.6 lb.)	810 ft./sec.	5.0″ Rocket (3.25″ Motor)

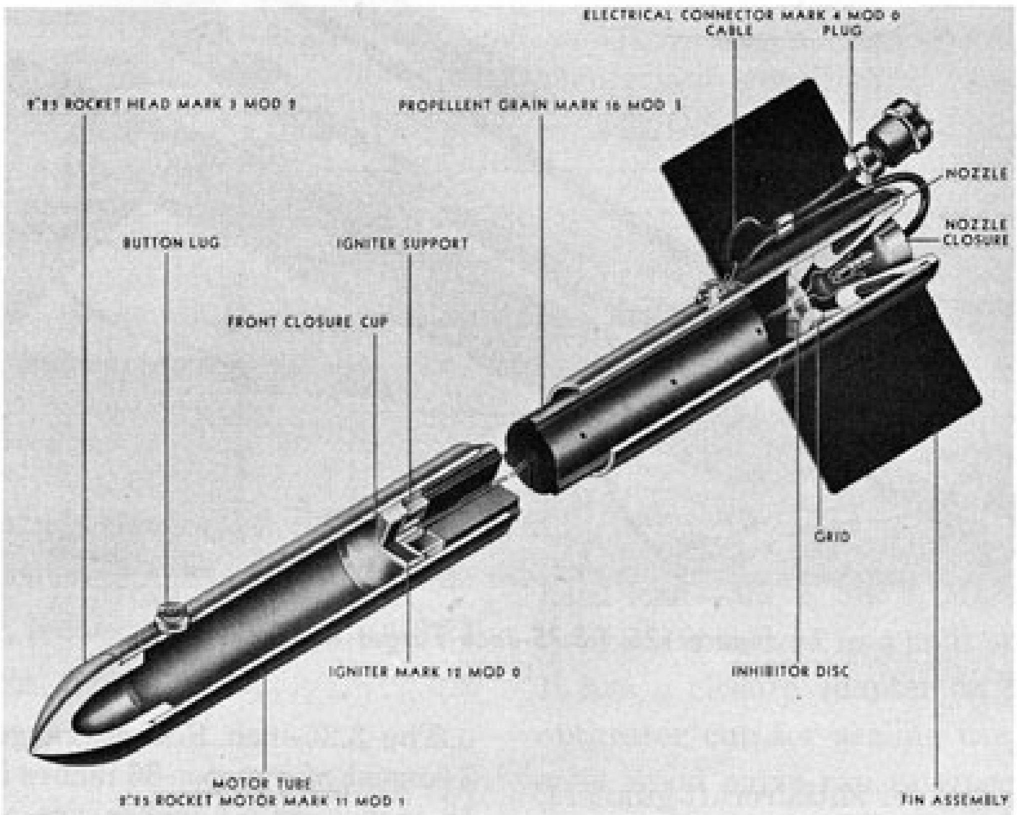


Figure 124. 2.25–inch A.R., Practice

2.25-inch A.R. Practice

General: The 2.25-inch sub-caliber rocket for aircraft was developed for training purposes. Initially, two types were designed to approximate the trajectory of the 3.5-inch and 5.0-inch rockets; however, only the Motor Mk 11 and the Head Mk 3 Mod 2 will be used in future training.

The Mk 1, a California Institute of Technology production, was issued until adopted and issued by Bureau of Ordnance as the Mk 3 Mod 2. The Mk 2, a California Institute of Technology production, was designed as a slow sub-caliber rocket. The complete assembly for the latter is no longer available.

The 2.25-inch Motors Mk 10 and Mk 11 are similar to each other, as are the 2.25-inch Motors Mk 12 and Mk 13. The Motors Mk 10 and Mk 11 differ from the Mk 12 and Mk 13 in that the diameter of the nozzle on the latter is smaller and the weight of the propellant of the Mk 10 and Mk 11 is 1.75 pounds, as compared to the weight of 1.12 pounds in the Mk 12 and Mk 13.

The external dimensions of these rockets are the same. For recognition purposes, the 2.25-inch motors Mk 10 and Mk 11 are painted white with black fins, while the Motors Mk 12 and Mk 13 are grey with black fins.

Motor Mk 11 and Head Mk 3 Mod 2: Over-all length of the rocket is 29 inches. Two button-type lugs are provided on the motor tube, spaced approximately 19 inches apart. Four fins are welded to the after end of the motor tube. The propellant is a cylindrical grain of ballistite weighing approximately 1-¾ pounds.

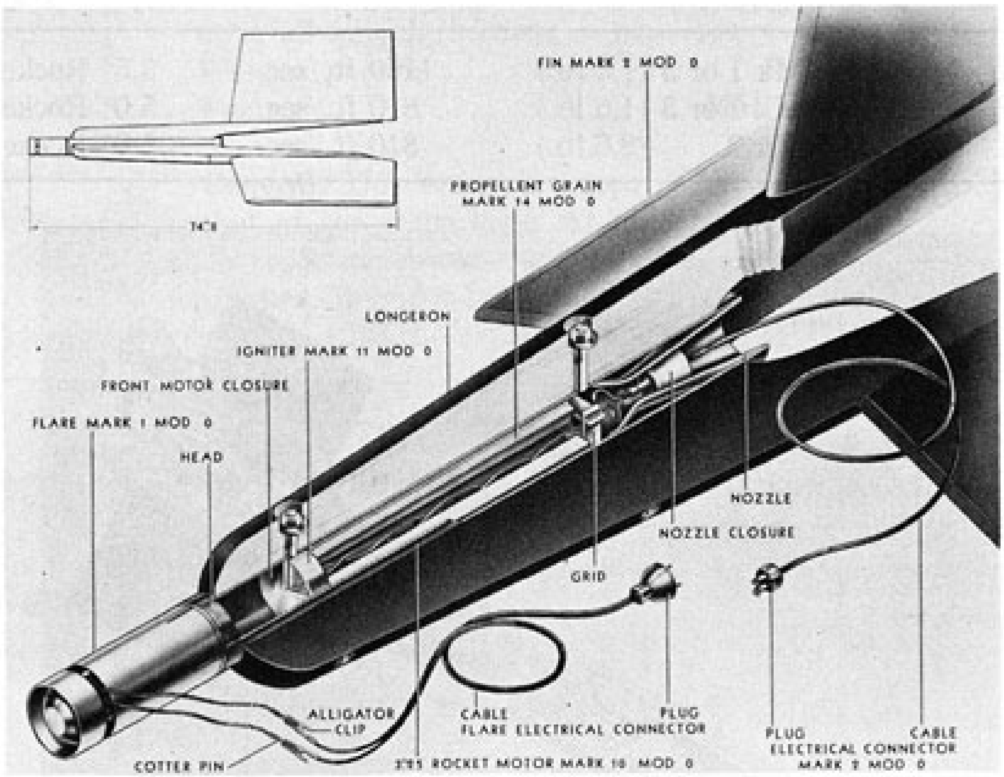


Figure 125. 3.25–inch Target Rocket

3.25-inch Targets

General: As a target for antiaircraft gunners, the rocket is projected with speeds approximating those of an aircraft. It consists of a rocket propulsive unit to which are attached large stabilizing fins, for maximum visibility. Rocket targets are referred to by their assembly number as indicated in the accompanying table. They all consist of a simple rocket motor with three large fins prepared from wooden frames and light-weight fiber board. The fins are 120 degrees apart, each attached by two lugs.

The 3.25-inch Rocket Targets Mk 1 and Mk 2 consist of a motor 36 inches long, to which fins 18 inches by 34 inches are attached. An electrical connection is made by a standard 110-volt plug. The 3.25-inch Target Rocket Mk 1 is standardized at 425 m.p.h. and the Mk 2 at 300 m.p.h. On some models, a screamer is put over the nose end.

The Mks 3 and 4 differ from Mks 1 and 2 in that the motor is heavier and the fins are held on by threaded studs instead of lugs. The ballistics are similar; Mk 3 is like Mk 1, and Mk 4 is like Mk 2.

3.25-INCH TARGET ASSEMBLIES

Mark	Assembly Number	Initial Velocity (m.p.h.)	Range	Maximum Elevation	Motor	Fin	Flare
1	3.25″ RT001	425	——	——	Mk 8	Mk 1	Flare
1	3.25″ RT002	425	——	——	Mk 8	Mk 1	None
2	3.25″ RT003	300	——	——	Mk 9	Mk 1	Flare
2	3.25″ RT004	300	——	——	Mk 9	Mk 1	None
3	3.25″ RT005	425	4500	1600	Mk 10 Mod 0	Mk 2 Mod 0	Mk 1 all Mods
3	3.25″ RT006	425	5000	1750	Mk 10 Mod 0	Mk 2 Mod 0	None
4	3.25″ RT007	300	3100	950	Mk 11 Mod 0	Mk 2 Mod 0	Mk 1 all Mods
4	3.25″ RT008	300	3400	1050	Mk 11 Mod 0	Mk 2 Mod 0	None

3.5-inch Window

Head Mk 10, Motor Mk 12

Over-all length, inches (approx.)	45.1
Weight, pounds	32
Head length, inches	23.2
Head weight, pounds (loaded)	14.25
Motor length, inches	23
Motor diameter, inches	3.25
Width of tail fins, inches	9.2
Length of tail fins, inches	8.0
Fuze	Base Fuze Mk 134

General: The window rocket is designed to be fired from Naval vessels equipped with a modification of the present shipboard launcher. The round carries a payload of paper-coated metal foil strips which are scattered in the air by a delayed-action charge. The payload is ejected at an altitude of 1,200 feet and range of 2,000 yards at 40° elevation.

Description: The window rocket consists of a 3.5-inch Rocket Head Mk 10 Mod 0, Mk 14 Mod 0, or Mk 15 Mod 0 and a 3.25-inch Rocket Motor Mk 12 Mod 0, Mk 14 Mod 0, or Mk 14 Mod 1. The motor uses the propellant grain Mk 7 Mod 1, weighing 2.80 pounds.

The rocket head contains a 3.5-inch rocket-head load—Mk 2, Mk 3, Mk 4, Mk 5, or Mk 8—which is housed in a split steel ejection liner. It has a closure adapter on the after end, an obturator cup for sealing the front end, and a solid wood ogive cap retained by three aluminum rivets in the Mk 10, hollow steel friction fit in the Mk 14 and Mk 15. The closure adapter, which is welded to the after end, carries a copper diaphragm plate with a firing pin, and also serves as a chamber for the Cal. 32 blank cartridge which ignites the fuze. The Fuze Mk 134 consists of a plastic case containing a length of Ensign Bickford fuse and a 20-gram ejector charge of black powder.

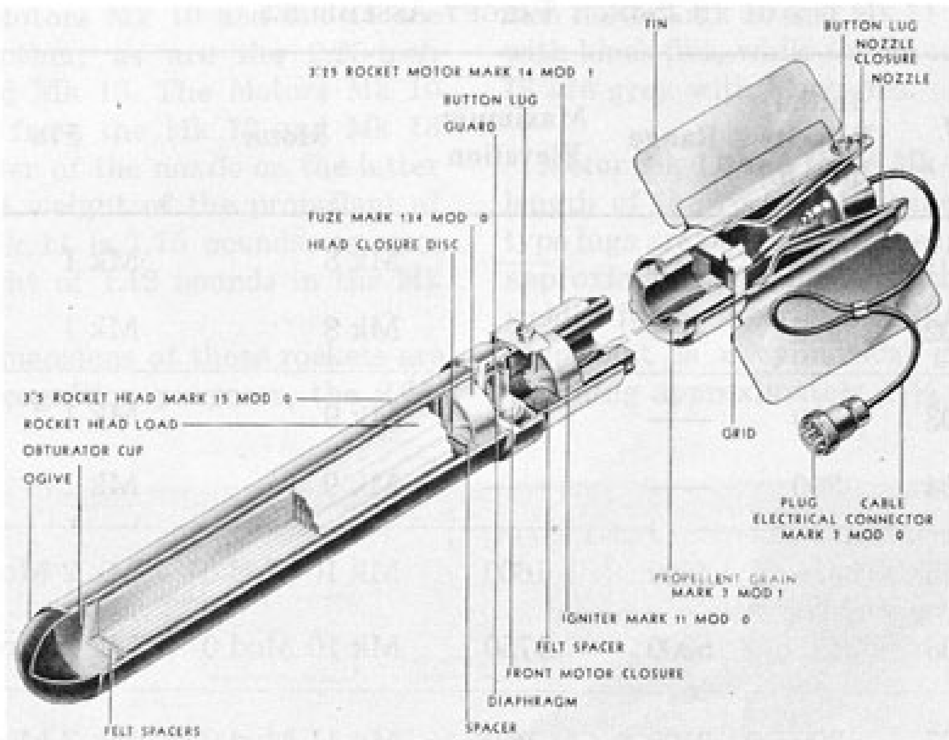


Figure 126. 3.5–inch Window Rocket

Rocket Body Load	Length of Strips	Number of Strips
Mk 1 Mod 0	10″	5,868
	15″	2,904
Mk 2 Mod 0	7.5″	17,544
Mk 3 Mod 0	12.5″	5,310
	15.5″	3,462
Mk 4 Mod 0	6″	11,676
	9″	5,868
Mk 5 Mod 0	1.87″	76,800
Mk 8 Mod 0	400 ft.	12 rolls

All strips are 3/16 inches wide and 0.003 inches thick except the Mk 8, which is ½ inch wide.

Operation: When the rocket is fired, gas pressure blows out the forward closure disc of the motor and exerts force on the diaphragm plate in the base of the motor adapter. The diaphragm collapses, and the firing pin is forced into the primer, firing the blank cartridge. The flash from the cartridge ignites the fuse, which burns for 15 seconds and then ignites the black-powder ejection charge. The firing of the ejector charge forces off the ogive cap and pushes the load forward out of the head. The strips are then dispersed.

Remarks: The Motors Mk 12 Mod 0 and Mk 14 Mod 0 carry adjustable lug bands; the lugs are welded to the Motor Mk 14 Mod 1. The Mk 14 Mod 0 and Mk 14 Mod 1 have a metal base cap during shipping, to protect the electrical connector.

The Head Mk 15 Mod 0 is one inch longer than the Head Mk 14 Mod 0.

3.5-inch Flare

3.5-inch Head Mk 14 Mod 0

Over-all length, inches (approx.)........47
Total weight, pounds..................33.5
Head length, inches....................23
Head weight, pounds..................16.5
Motor length, inches..................24.5
Motor diameter, inches...............3.25
Fuze (Head Mk 14).......Base Fuze Mk 134
Fuze (Head Mk 15).......Base Fuze Mk 128

General: The 3.5-inch rocket flare was developed for use from surface ships, particularly motor torpedo boats. The illuminant candle produces an average of 800,000 candle power for approximately twenty-nine seconds. The rocket motor carries the flare out 1,800 yards before ignition.

The flare consists of the following major components: 3.25-inch Motor Mk 12 Mod 0, Mk 14 Mod 0, or Mk 14 Mod 1; 3.5-inch Head Mk 10 Mod 0, Mk 14 Mod 0, or Mk 15 Mod 0; and Body Load (Flare) Mk 7 Mod 0.

Head: All the heads are interchangeable and differ only in minor details. The 3.5-inch Head Mk 10 Mod 0 has a wooden nose piece held in place by three shear pins, while the Mk 14 Mod 0 and Mk 15 Mod 0 have a sheet-metal nose piece press-fitted in place. The Mk 15 Mod 0 is one inch longer than the other two.

The head consists of a 3.25-inch seamless steel tube which incorporates a 3.5-inch diameter closure adapter welded to the after end. This closure adapter carries a copper diaphragm plate with a firing pin, and serves as a chamber for the caliber .32 blank cartridge which ignites the fuze. The balance of the head is taken up by the candle and parachute from the 4-inch illuminating projectile, the composition of the candle slightly changed to increase the candlepower in the shorter burning time.

Motors: The three motors are similar and interchangeable. The principal distinguishing feature of the 3.25-inch Motor Mk 14 Mod 1 is the use of welded-on launcher lugs replacing the lug bands employed on the earlier models. The motor housing is a 3.25-inch seamless steel tube containing a forward closure disc, Igniter Mk 11 Mod 0, Tubular Ballistite Grain Mk 7 Mod 1 (2.8 pounds), steel grid, welded nozzle, and pigtail. Four tail fins, three inches by eight inches, are mounted on a sleeve fixed to the after end. A thread protector on the forward end and shipping cover taped on the after end protect the motor in shipment. The 3.25-inch Motor Mk 12 Mod 0 does not have a shipping cover on the after end.

Operation: This rocket is similar to the Window rocket in operation.

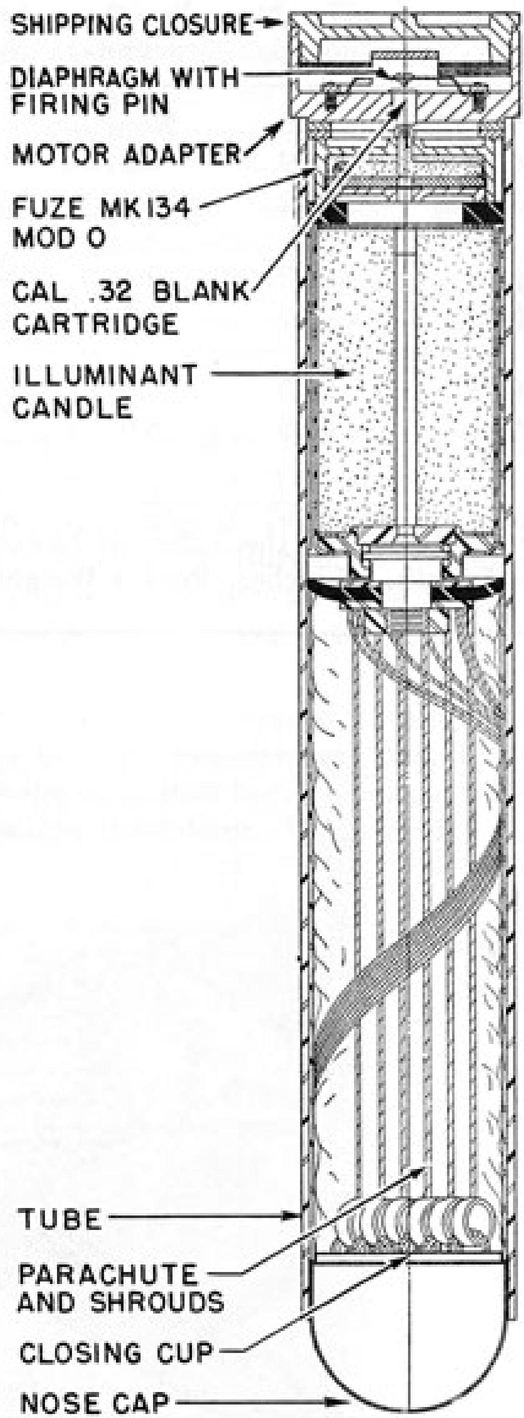


Figure 126A. 3.5-inch Rocket Flare

3.5-INCH AND 5.0-INCH A.R. WITH 3.25-INCH MOTORS—ASSEMBLIES

Head	Head Weight (pounds)	Filling Weight (pounds)	Head Length (inches)	Total Weight (pounds)	Total Length (inches)	Fuzing
3.5″ Mks 1, 2	20.0	None	9.7	53.8	54.7	None
3.5″ Mks 3, 5	19.9	2.2	13.8	53.7	58.9	Mk 148, Mk 149
3.5″ Mk 4	20.2	1.0	13.4	53.9	58.5	Mk 146
3.5″ Mk 6	20.0	9.4	21.2	53.8	68.0	Mk 155
3.5″ Mk 9	20.0	9.4	19.6	53.0	66.5	Mk 149, Mk 148
3.5″ Mk 8	20.0	0.0	11.75	53.8	57.75	None
5.0″ Mk 1	46.5	8.6	19.7	80.3	64.8	Mk 148, Mk 149, Mk 146, Mk 157, Mk 165

Motor: All heads use the 3.25-inch Motor Mk 7.
Rocket Length: 46 inches; **Rocket Weight:** 33.8 pounds

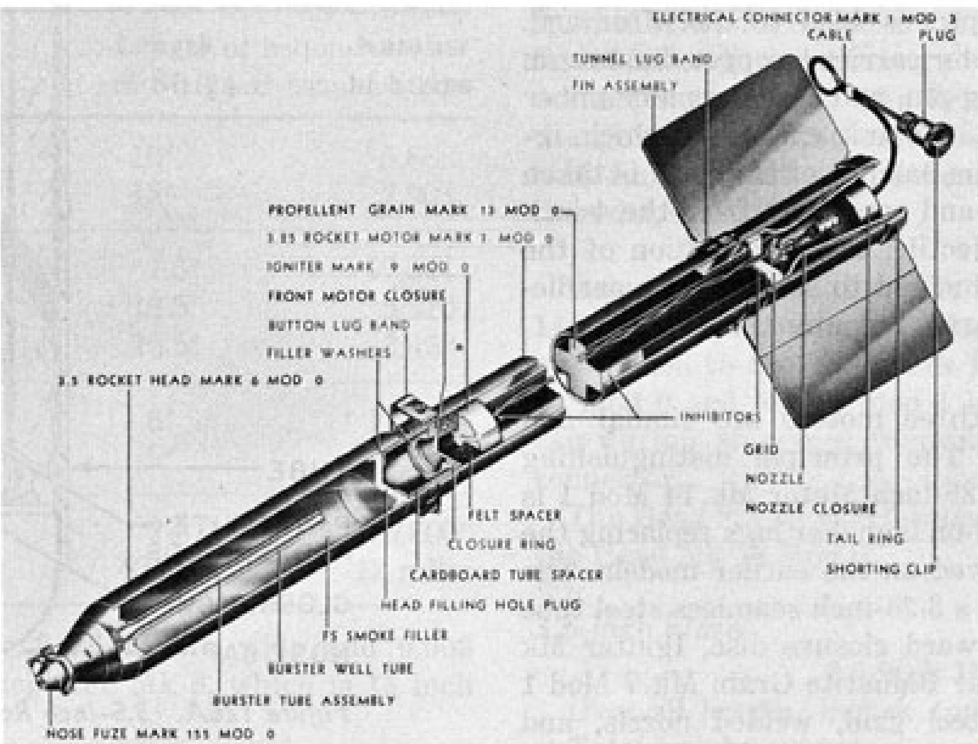


Figure 127. 3.5–inch A.R. (Head Mk 6)

3.5-inch and 5.0-inch A.R. with 3.25-inch Motors

General: The 3.5-inch rockets were designed to be used against smaller targets, such as submarines and tanks. For larger targets, the 5.0-inch rocket was developed from the 5-inch antiaircraft shell. The 3.5-inch Solid Head Mk 8 and the 3.5-inch F.S. and P.W.P. Smoke-Filled Heads Mk 6 are the only ones now being issued. The 3.5-inch H.E. heads were replaced by the 5.0-inch heads. The former were never issued, because of the small load of TNT carried, as compared to the 5.0-inch heads.

Heads

3.5-inch Mks 1 and 2: The head is of solid steel and contains no high explosive or fuze. The shape of the round gives a relatively long underwater travel at shallow depth-of-entry angles (about 20 degrees), and it is used as a semi-armor-piercing projectile against submarines or tanks. The Mk 1 was the California Institute of Technology production which was adopted by Bureau of Ordnance and designated the Mk 2.

3.5-inch Mks 3 and 5: The head is filled with TNT and fitted with an adapter in the nose to take the Fuze Mk 149. With a second adapter, the diameter is reduced to 1.5 inches to take the Fuze Mk 148. These rounds were not issued and were replaced by the 5.0-inch heads, which contain a greater load of high explosive.

3.5-inch Mk 4: The head has a semi-armor-piercing nose and is filled with TNT. This round was not issued, because of the small load of high explosive, and was replaced by the 5.0-inch heads.

3.5-inch Mks 6 and 9: The head is filled with F.S. or P.W.P. smoke. The Mk 9, the initial California Institute of Technology production, was not issued. The Bureau of Ordnance, in adopting this head, increased the length 1-1/2 inches and issued the round as the Mk 6.

3.5-inch Mk 8: The head is of solid steel and contains no high explosive or fuze. The round was developed to give better underwater travel, and replaces the 3.5-inch Head Mk 2.

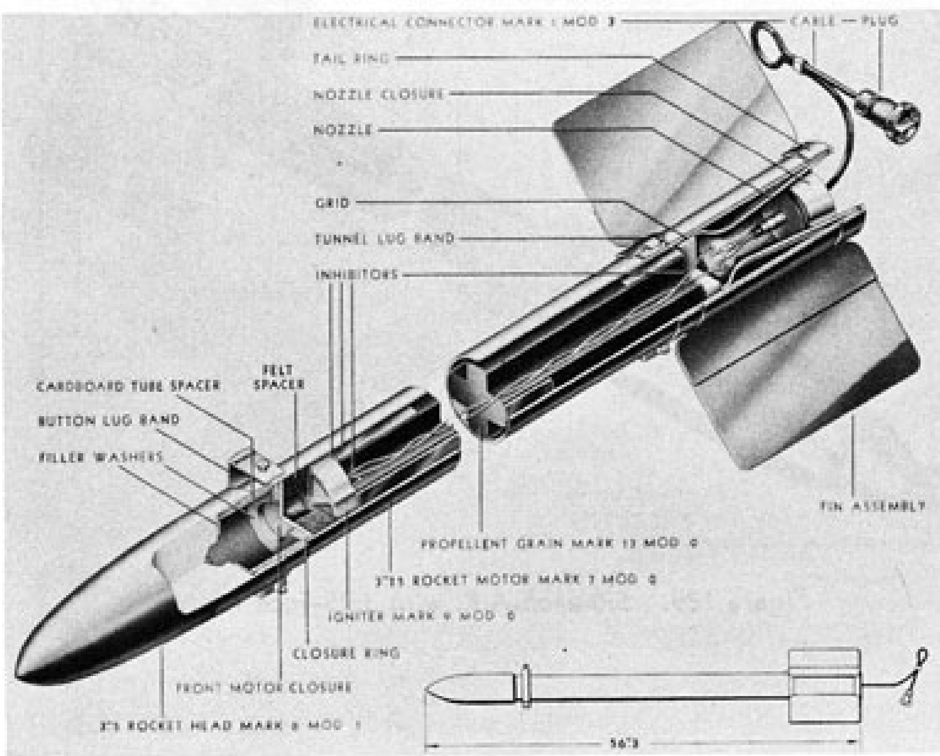


Figure 128. 3.5–inch A.R. (Head Mk 8)

5.0-inch Mk 1 Mod 0: The head is filled with TNT and weighs 46.5 pounds when fitted with a Fuze Mk 143. The same adapter rings are used as on the 3.5-inch Head Mk 5. The head is issued with a nose plug. The nose fuze must always be assembled in the head before firing. Fire with the fuze on "safe" if delay is desired. The head is shipped with the base fuze sealed in place. This base fuze must not be removed.

5.0-inch Mk 1 Mod 1: This head differs from the 5.0-inch Head Mk 1 Mod 0 only in that the nose is especially cavitated to take the Fuze Mk 172 Mod 0, which is larger than the Mk 149 or other nose fuzes and therefore is not interchangeable with them.

MOTOR

The 3.25-inch Motor Mk 7 is used with the 3.5- and 5.0-inch heads described above. At the forward end of the motor are a black-powder igniter and an electric squib. Two electric leads extend through the motor and out the after end to a cable and plug connection. At the after end of the motor, there are a nozzle and a bag of silica gel which acts as a dehydrating agent in keeping moisture from the ballistite grain. The grain used in the cruciform type with inhibitors, 33 inches long, 2.75 inches in diameter, and weighing 8.5 pounds.

The tail consists of four sheet-metal fins set 90° apart and welded to a central cylinder. The tail is slipped over the after end of the motor and is secured by a tail locking ring, which screws on.

Remarks: The 3.5-inch (H.E. and F.S.) have a maximum velocity of 1,200 ft./sec. exclusive of plane speed, as compared to 800 ft./sec. for the 5.0-inch H.E.

The 3.5-inch Heads Mk 11, incendiary, and Mk 12, gas, were never loaded.

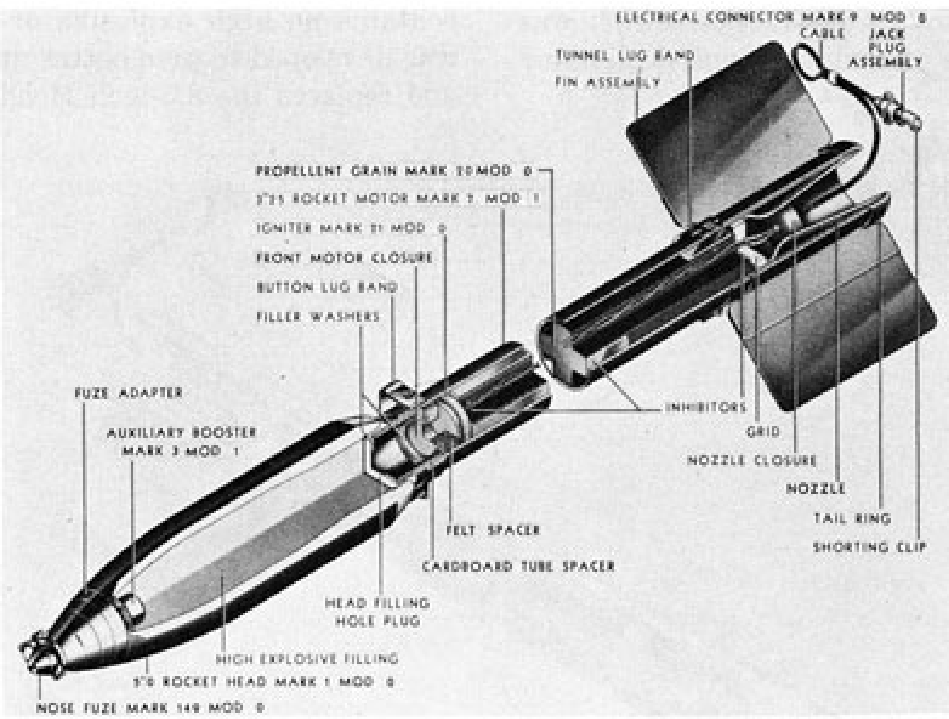


Figure 129. 5.0–inch A.R. with 3.25–inch Motor

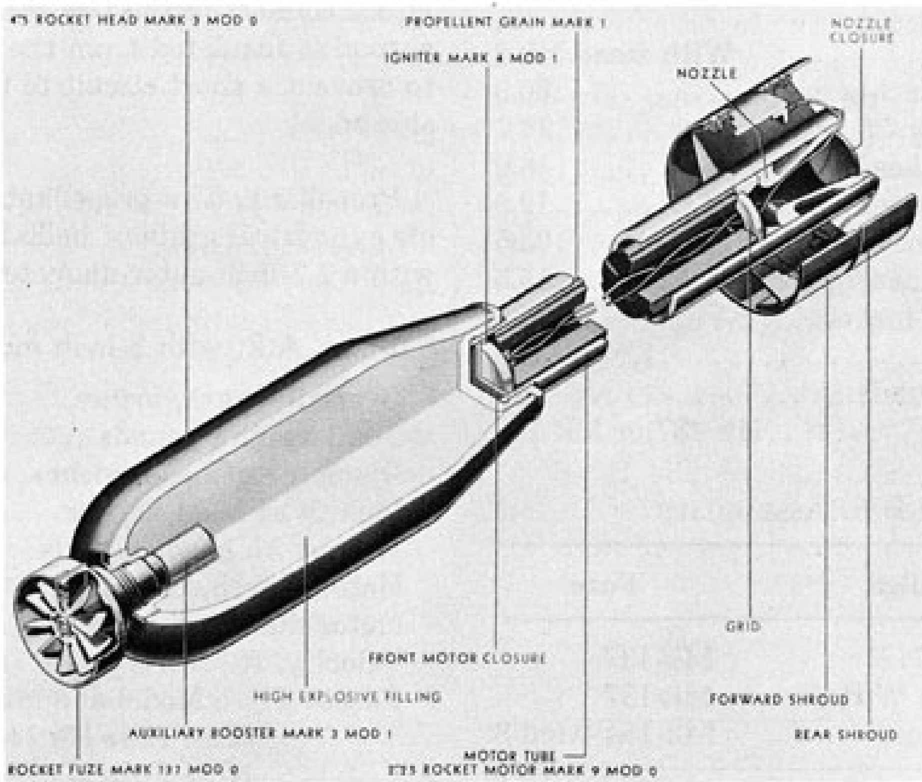


Figure 130. 4.5–inch B.R. (Head Mk 3)

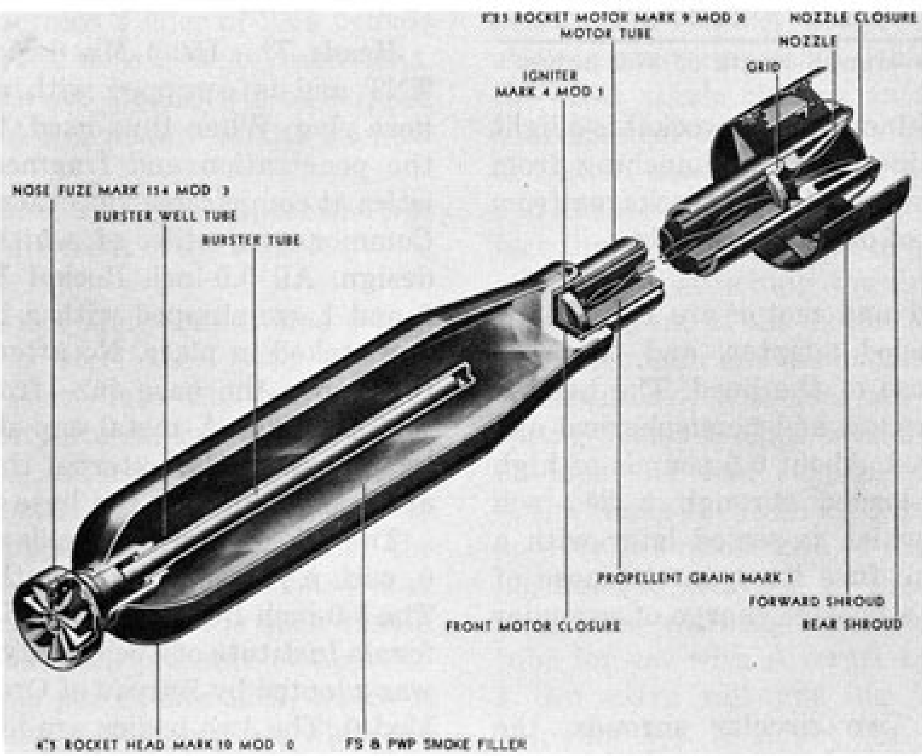


Figure 131. 4.5–inch B.R. (Head Mk 10)

4.5-inch B.R.

	With Head Mk 3
Over-all length, inches	30.0
Total weight, pounds	28.7
Head length, inches	13.0
Head weight, pounds	19.9
Wall thickness, inch	0.25
Motor length, inches	15.5
Motor diameter, inches	2.25
Range, yards	1,000-1,100
TNT charge, pounds	6.5
Fuzes	Mk 137 or Mk 145

4.5-INCH B.R. ASSEMBLIES

Head	Filler	Fuze
Mk 3	TNT	Mk 137
Mk 5	F.S., W.P.	Mk 137 Mk 154 Mod 3
Mk 7*	F.S., W.P.	Mk 137 Mk 154 Mod 3
Mk 3	TNT	Mk 145
Mk 10	P.W.P.	Mk 154 Mod 3
Mk 11	TNT	Mk 137

*Head Mk 7 makes over-all length of 37.0 inches.

General: The 4.5-inch barrage rocket is a light demolition rocket intended for launching from landing boats, from amphibious trucks, or from portable launchers of one or more rails.

Head: The head and motor are coupled by means of a threaded adapter, and the fuze screws into the nose of the head. The head is cylindrical, the forward and hemispherical and the rear end reduced. About 6.5 pounds of high explosive can be loaded through a 2¾-inch hole in the rear, which is sealed later with a motor adapter. The fuze liner, in the nose of the head, contains a booster charge of granular TNT.

Tail assembly: Two circular shrouds, the same diameter as the body, are attached to supporting fins at the rear of the motor. Two wires brought out through the powder grain and the nozzle connect to the two shrouds. The forward shroud is insulated from the rest of the rocket to prevent a short circuit to the after grounded shroud.

Propellant: The propellant consists of a single cylindrical grain of ballistite 11 inches long, with a 1.7-inch outer diameter.

5.0-inch A.R. with 5-inch motor

Over-all length, inches	69
Total weight, pounds	140
Diameter of head, inches	5.0
Length of head, inches	20.3
Weight of head, pounds	52
Motor length, inches	51.4
Motor diameter, inches	5.0
Velocity, ft./sec.	1,350

Fuzes: Mk 5 Mod 0 and Mk 6 Mod 0
- Nose Fuze Mk 148
- Nose Fuze Mk 149
- Base Fuze Mk 157 Mod 0
- Base Fuze Mk 159 Mod 0

Mk 6 Mod 1
- Base Fuze Mk 159 Mod 1
- Base Fuze Mk 164 Mod 0

Head: The Head Mk 6 Mod 0 is filled with TNT and is equipped with a base fuze and a nose plug. When thus used, the head will have the penetration and fragmentation characteristics at comparable velocities of the 5"/38 A.A. Common projectile, of which it is a modified design. All 5.0-inch Rocket Heads Mk 6 Mods 0 and 1 are shipped with a base fuze installed and staked in place. No attempt shall be made to remove the base fuze from the head prior to the firing. A metal cup-shaped thread protector covers the external threads on the base of the head and on the base fuze.

The Mk 6 Mod 1 is similar to the Mk 6 Mod 0, with a gas seal added to the bomb-fuze seat. The 5.0-inch Body Mk 5 Mod 0 is the initial California Institute of Technology production, which was adopted by Bureau of Ordnance as the Mk 6 Mod 0. The two bodies are identical.

The 5.0-inch Aircraft Common Mk 2 Mod 1 is a new head designed to achieve greater penetration. This penetration is expected to be two

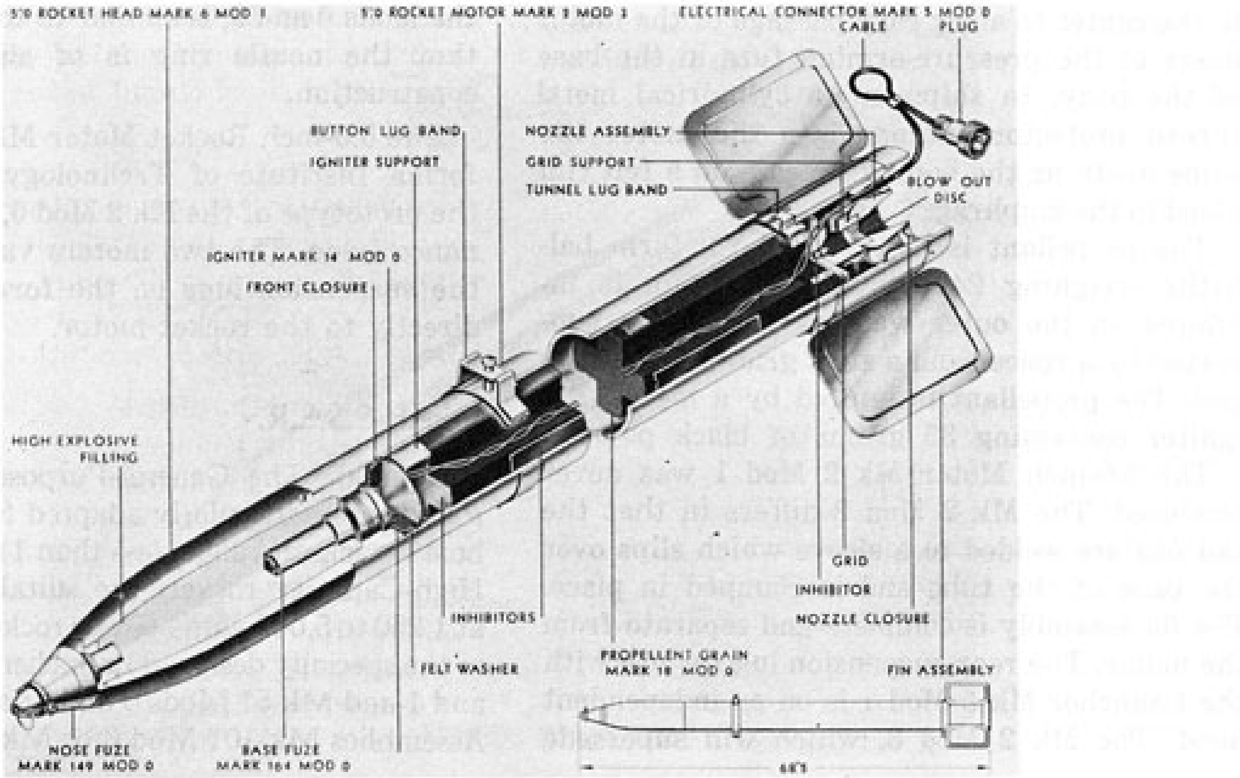


Figure 132. 5.0–inch A.R. with 5.0–inch Motor

to three inches of homogeneous armor plate at launching speeds of 1,500 feet per second. The head has a total weight of 48.1 pounds, is 14 inches long, and contains a filler of 2.66 pounds of Explosive "D." The nose is heavy and solid. A base fuze (the Mk 166 Mod 0) will be shipped installed. This head will fit any of the 5.0-inch motors.

The Head Mk 2 Mod 2 has no adapter and has Acme threads; otherwise it is the same.

Motor: The 5.0-inch Motor Mk 2 Mod 0 consists of a seamless steel tube with internal threads on both ends. Into the rear end is screwed the nozzle plate having eight nozzles arranged in a circle, and a central blow-out nozzle. The central nozzle is closed by a disc of 0.024-inch thick copper, insulated against the heat of the motor by asbestos and hard fiber plugs. The thickness of the disc is such that it shears and blows out at a pressure of approximately 2,400 pounds per square inch, which is the normal maximum motor pressure when the propellant grain is at a temperature of 100° F. If the pressure rises above this, the disc and plug are ejected; this increases the usable temperature range of the rocket by about 40° F.

Seven of the eight nozzles are sealed individually by a light steel cup and sealing compound. The eighth nozzle accommodates the electric connector cable, which is crimped into the steel nozzle closure. In shipment, a dome-shaped steel shipping cap fits into the sleeve of the fin assembly, acting as an auxiliary seal and at the same time serving to enclose and protect the electrical pigtail in shipment.

Lugs for attaching the fins are mounted on the nozzle end of the motor. The fins are shipped with the motor and are attached when the round is assembled. The fins are held in place by spring-loaded latches within the fin itself. The fin lugs and rear suspension lugs are welded to the bands of the fin assembly, which is slipped on over the nozzle end of the motor. The front lug band is strapped to the motor. The motor is shipped with lug attachments on the motor tube for use with Aircraft Launcher Mk 5 Mod 1. An extra rail-type lug is provided in the shipping box to adapt the rocket for use on the Aircraft Launcher Mk 4.

The front end of the motor is sealed by a steel diaphragm equipped with a blow-out disc

in the center to allow easy passage of the motor gases to the pressure-arming fuze in the base of the body. In shipment, a cylindrical metal thread protector extends into the motor the same depth as the body and seats on a felt rim glued to the diaphragm seal.

The propellant is a grain of cruciform ballistite weighing 24 pounds. The grain is inhibited on the outer web surface and is supported by a spacer and a steel grid at the nozzle end. The propellant is ignited by a metal case igniter containing 35 grams of black powder.

The 5.0-inch Motor Mk 2 Mod 1 was never produced. The Mk 2 Mod 2 differs in that the tail fins are welded to a sleeve which slips over the base of the tube and is clamped in place. The fin assembly is complete and separate from the motor. The rear suspension lug for use with the Launcher Mk 5 Mod 1 is on an independent band. The Mk 2 Mod 3, which will supersede the Mods 0 and 2, is similar to the Mod 2, except that the nozzle ring is of slightly different construction.

The 5.0-inch Rocket Motor Mk 1 Mod 0, California Institute of Technology production, is the prototype of the Mk 2 Mod 0, Bureau of Ordnance issue. The two motors vary only in that the suspension lugs on the former are welded directly to the rocket motor.

5-inch S.S.S.R.

General: The General-Purpose and Common rounds are particularly adapted for repelling PT-boat attacks at ranges less than 11,000 yards. The High-Capacity rockets are suitable for barrages at 1,250 to 5,000 yards. These rockets must be used in the specially designed Launchers Mk 50 Mods 0 and 1 and Mk 51 Mods 0 and 1; and in Launcher Assemblies Mk 101 Mod 0 or Mk 102 Mod 0.

DATA

	General-Purpose	Common	H.C. (5,000 yds.)	H.C. (2,500 yds.)	H.C. (1,250 yds.)
Head	5.0″ Mk 7 All Mods	5.0″ Mk 8 All Mods	5.0″ Mk 10 All Mods	5.0″ Mk 12 All Mods	5.0″ Mk 13 All Mods
Motor	5.0″ Mk 3 All Mods	5.0″ Mk 3 All Mods	5.0″ Mk 4 All Mods	5.0″ Mk 5 Mod 1	5.0″ Mk 6 Mod 0
Propellant grain	Mk 21 Mod 0	Mk 21 Mod 0	Mk 22 Mod 0	Mk 24 Mod 0	Mk 25 Mod 0
Igniter	Mk 17 Mod 0	Mk 17 Mod 0	Mk 18 Mod 0	Mk 20 Mod 0	Mk 20 Mod 0
Motor length	22.5″	22.5″	15.28″	10.50″	8.845″
Over-all length	31.5″	28.8″	32.2″	32.2″	32.2″
Head weight	20 lb.	20 lb.	24.6 lb.	31.4 lb.	34.35 lb.
Filler	TNT	Explosive "D"	TNT	TNT	TNT
Weight	1.75 lb.	1.68 lb.	9.6 lb.	12.4 lb.	13.6 lb.
Total weight	49.1 lb.	50.8 lb.	50.2 lb.	—	—
Fuzes:					
Nose	Mk 100 Mod 0	None	Mk 30 Mod 3 or Mk 173	Mk 30 Mod 3 or Mk 173	Mk 30 Mod 3 or Mk 173
Base	None	Mk 31 Mod 0	None	None	None
Aux. Det.	Mk 44 Mod 2	None	Mk 44 Mod 1	Mk 44 Mods 1 and 2	Mk 44 Mods 1 and 2
Range	11,000 yd.	11,000 yd.	5,250 yd.	2,500 yd.	1,250 yd.
Velocity	1,530 ft./sec.	1,600 ft./sec.	830 ft./sec.	475 ft./sec.	340 ft./sec.

HEADS

5.0-inch Head Mk 7—General-Purpose: This head is threaded externally at the after end to accommodate the motor. It is threaded internally at the forward end to accommodate the fuze adapter for Rocket Fuze Mk 100 and

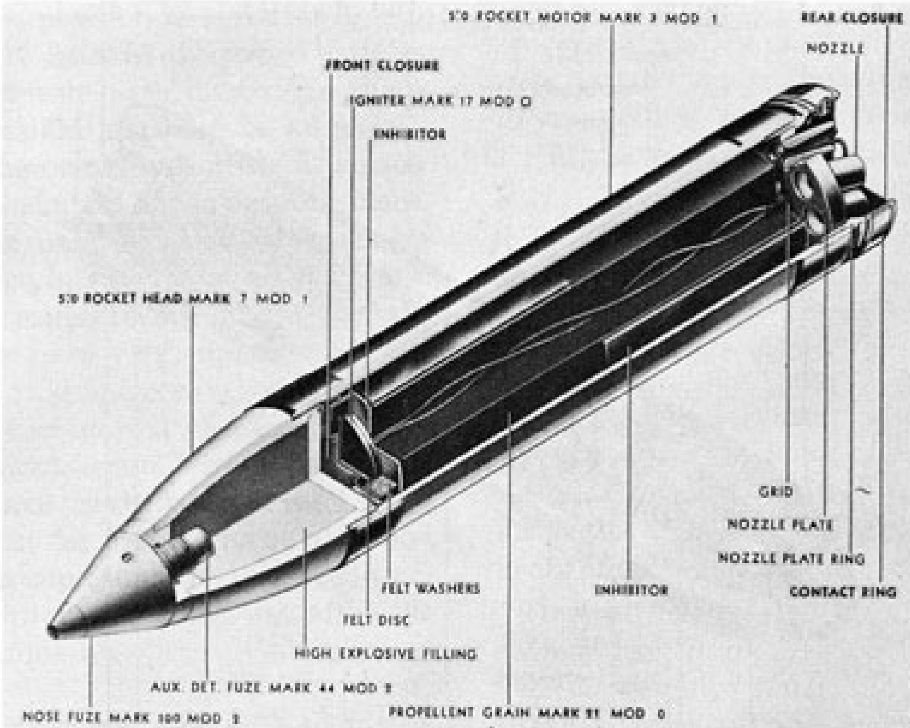


Figure 133. 5.0–inch S.S.S.R. (Head Mk 7 Mod 1)

Mods. Two spanner holes are located in the after end of the head spaced 180° apart to facilitate assembly. The fuze adapter is internally threaded for Auxiliary Detonator Fuze Mk 44 Mod 2. The Nose Fuze Mk 100, all Mods, is screwed in over the Auxiliary Detonating Fuzes. (The fuze adapter and an Auxiliary Detonator Mk 44 Mod 2 are shipped installed in the head.)

5.0-inch Head Mk 8 and Mods—Common: This head is internally threaded at the after end to take Base Fuze Mk 31. It has two spanner holes 180° apart to facilitate assembly operations.

5.0-inch Head Mk 10 and Mods—High Capacity: The nose of this head is internally threaded to fit Nose Fuze Mk 30 Mod 3 and a fuze adapter. It has two spanner holes 180° apart near the base end to facilitate assembly operations. The fuze adapter is internally threaded to hold Auxiliary Detonator Mk 44 Mod 1, and the Nose Fuze Mk 30 Mod 3 fits over the auxiliary detonator.

5.0-inch Head Mk 12 and Mods—High Capacity: The 5.0-inch Head Mk 12 and Mods is 3.125 inches longer than the 5″ Mk 10 head used in the 5,000-yard round. It carries about 2.8 pounds more TNT than the Head Mk 10.

5.0-inch Head Mk 13 and Mods—High Capacity: The 5.0-inch Head Mk 13 and Mods is 4.78 inches longer than the 5.0-inch Head Mk 10. It also carries about four pounds more TNT.

Motors

5.0-inch Motor Mk 3 and Mods: The motor tube is a seamless steel tube with internal threads at both ends. It is machined with a bourrelet ring at each end. The front closure is a steel disc pressed in position near the front end of the motor tube. It seals the front end from moisture, dirt, etc., and retains the igniter and propellant grain in place. A thin felt pad cushions any contact between the front closure and the igniter. The Igniter Mk 17 Mod 0 consists of a flat tin case containing 35 grams of black powder and an electric squib. A felt disc one inch thick protects the grain from accidental shock. It has an eccentrically placed hole which houses and forms a snug fit for the igniter case. The propellant is an inhibited, cruciform grain weighing approximately ten pounds. The nozzle plate assembly consists of eight nozzles and a grid mounted on a nozzle plate. The cylindrical **T**-shaped steel grid is pressed into

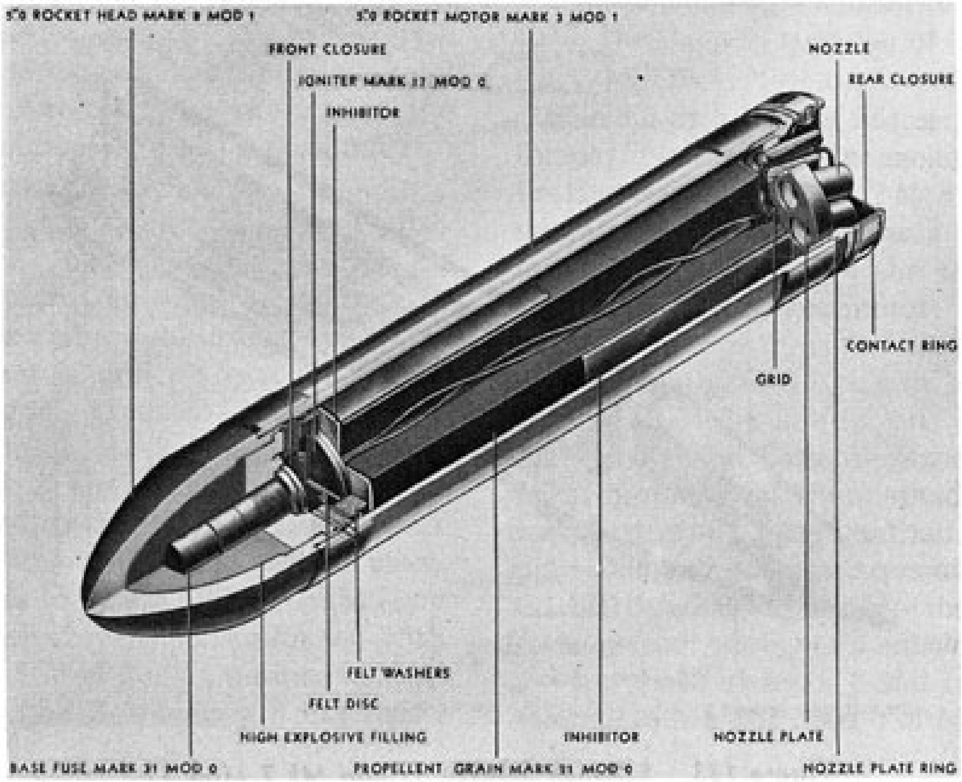


Figure 134. 5.0–inch S.S.S.R. (Head Mk 8 Mod 1)

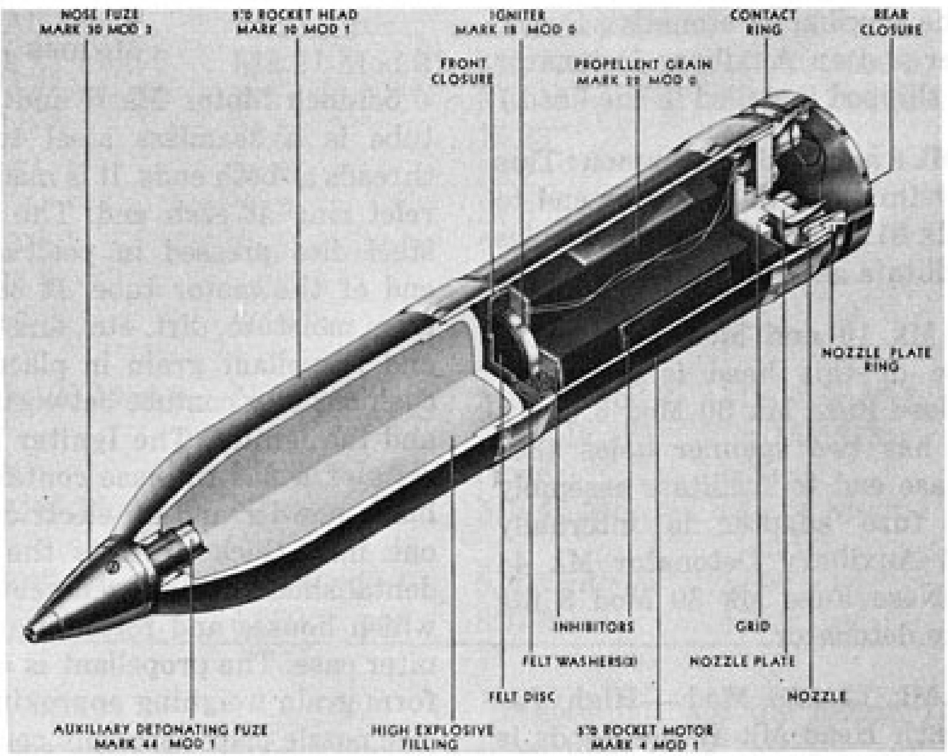


Figure 135. 5.0–inch S.S.S.R. (Head Mk 10 Mod 1)

place and peened in position in a center hole in the nozzle plate. It acts as a spacer between the grain and the nozzle plate, creating a chamber which equalizes the pressure to all nozzles during burning. The nozzles are press fitted into the plate and are canted 12° to give a clockwise rotation. The nozzle-plate ring assembly consists of a nozzle-plate ring and the insulated contact ring. The contact ring is a steel band around the nozzle-plate ring and is insulated from it. The plate ring and contact ring are the two terminals of the ignited electrical circuit. The rings are short circuited by a band. The short-circuiting band must be removed when preparing the rocket for firing. The rear closure is a thin aluminum cup cemented in place in the after end of the motor, and blows out after the motor pressure builds up.

5.0-inch Motor Mk 4 and Mods: The 5.0-inch Rocket Motor Mk 4 is similar to the Mk 3 discussed above, except that the motor tube is seven inches shorter than the Motor Mk 3. The Igniter Mk 18 with shorter leads is used. Propellant Grain Mk 22 Mod 0, shorter and weighing approximately 5.5 pounds, is used. The nozzle in the nozzle-plate assembly has a smaller throat diameter.

5.0-inch Motor Mk 5 Mod 1: The Mk 5 Mod 1 is similar to the Mk 4, except that it is 3.125 inches shorter and the nozzle plate has four instead of eight nozzles. This shorter motor gives a range of 2,500 yards and a maximum velocity of 475 ft./sec., which is suitable for barrage purposes.

5.0-inch Motor Mk 6 Mod 0: The Mk 6 Mod 0 is also similar to the Mk 4 and Mods, except that it is 4.78 inches shorter and the nozzle plate has only four nozzles. The cant of these nozzles has been increased to insure stable flight of the round at slower velocities. This shorter motor gives a range of 1,250 yards and a maximum velocity of 340 ft./sec., which is suitable for barrage purposes.

7.2-inch H.E. "Mouse Trap" and 2.5-inch Practice

Over-all length, inches	38.6
Head length, inches	19.0
Head weight, pounds	17.9
Filler weight (TNT), pounds	31.0
Wall thickness, inch	0.2
Motor length, inches	15.9
Motor diameter, inches	2.25
Motor weight, pounds	8.1
Tail width, inches	7.0
Total weight, pounds	65

General: This rocket was designed for use by patrol vessels against submarines. The most common installation consists of two four-rail Launchers Mk 20, with a fixed elevation of 48°, mounted on the fore deck with firing controlled from the bridge.

COMPLETE ROUNDS

Assembly No.	Head	Filling	Grain	Fuze
7.2″ H.E. 208 (Obsolete)	7.2″ Mk 4	TNT	Mk 3	Mk 131—Mk 156
7.2″ H.E. 211	7.2″ Mk 5	TPX	Mk 3	Mk 131—Mk 156
7.2″ H.E. 212	7.2″ Mk 5	TPX	Mk 3	Mk 140—Mk 156
7.2″ H.E. 213	7.2″ Mk 5	TNT	Mk 10	Mk 131—Mk 156
7.2″ H.E. 216	7.2″ Mk 5	TNT	Mk 10	Mk 140—Mk 156
7.2″ H.E. 217	7.2″ Mk 4	TNT	Mk 3	Mk 140—Mk 156

In addition to the service rounds, there are the Mks 106 and 109 filled with plaster for target practice, and the Mks 206 and 209 filled with plaster for drill.

Head: The projectile consists of a flat-nosed head with a conical tail fairing and parallel sides. The adapter and fuze thread into the nose, and the motor unit threads into the base.

Motor: The Motor Unit Mk 3 contains a long single pellet of smokeless powder which, when ignited by a black-powder primer fired by an electric squib, burns at a pressure of 1,000 to 2,500 pounds per square inch. The gases are forced out aft through the nozzle in the rear end of the motor tube. The burning continues for 0.2 to 0.7 second, during which time the missile travels about 30 feet. At this point, propulsion ceases and the projectile is free in flight. This projector charge is intended for use on the 7.2-inch Rocket Launchers Mk 20, Mk 21, or Mk 22.

Tail: A steel tube attached to the head by a threaded joint has fins with two circular drums attached to the after end. The vanes have a 10-degree twist to give a slow rotation and prevent ruddering. The two vane-support drums also act as contact rings, the wiring from the electric squib passing from the primer aft to the two rings which serve as firing contacts.

Remarks: When Torpex is used, the weight is increased by approximately 2.5 pounds.

The 2.5-inch sub-caliber rocket, consisting of the 1.25-inch Motor Mk 1 and 2.5-inch Head Mk 1, is a miniature of the regular rocket and is used in practice. The motor contains a single tubular powder grain, an igniter, and lead wires. The tail fins, supported by a shroud, are offset five degrees to impart some rotation to the round, to improve underwater travel. The Head Mk 1 has a cavity for a shot-gun shell; the Head Mod 2 Mk 1 is solid.

The Fuzes Mk 131 and Mk 140 are replaced by the Mk 156 in the service rounds.

7.2-inch D.R., also T37 and T88

Head Mk 10

Over-all length, inches 35
Motor diameter, inches 2.25
C–2 explosive, pounds 33
Loaded weight, pounds 60
Maximum range, yards 275
Motor .... 2.25-inch Mk 3
Fuze
  Head Mk 5 ..... Nose—Mk 152 or Mk 141
  Head Mk 10 .... Base—Mk 146
  Head Mk 10–1 .. Base—Mk 161 Mod 0

General: The 7.2-inch D.R., a modification of the 7.2-inch H.E., was used for demolition of anti-tank obstacles. The 7.2-inch D.R. was projected from a multiple-rail armored launcher

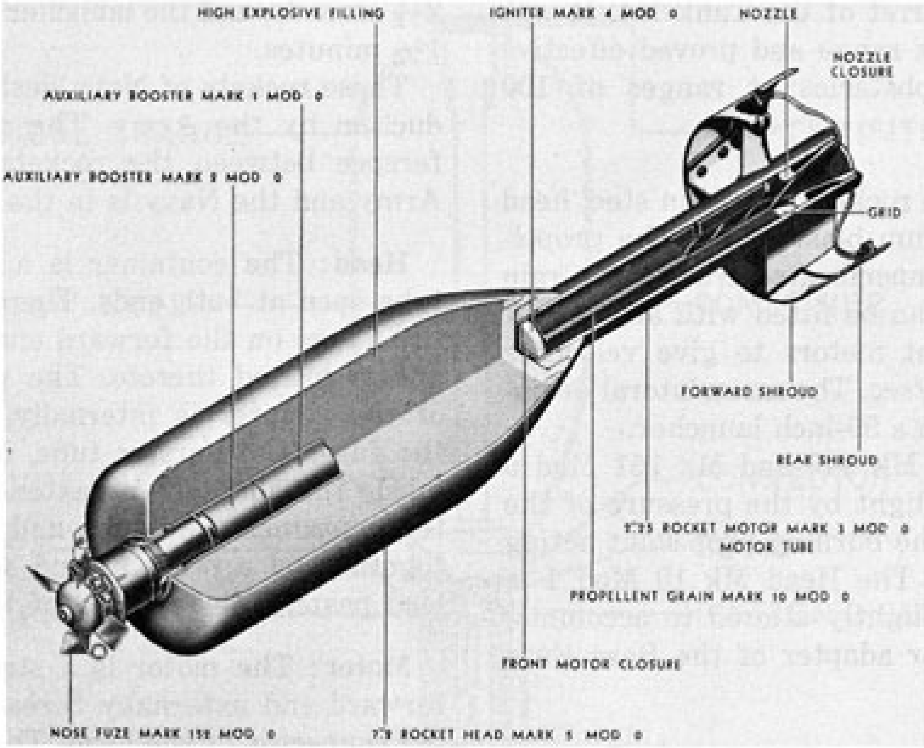


Figure 136. 7.2–inch D.R. (Head Mk 5)

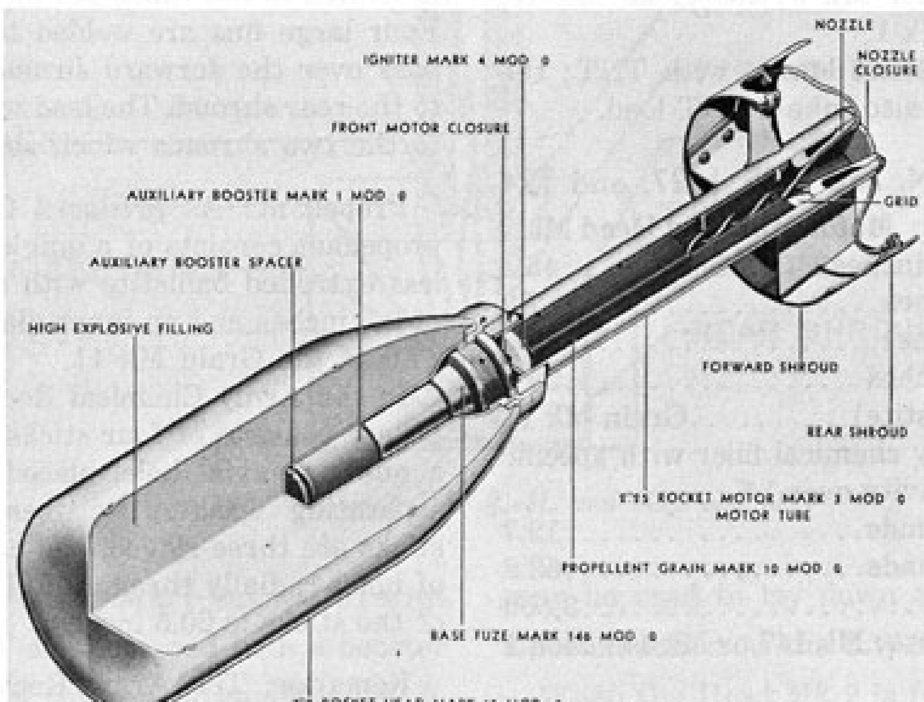


Figure 137. 7.2–inch D.R. (Head Mk 10)

mounted on the turret of the Tank M4. It was fired at point-blank range and proved effective against concrete obstacles at ranges of 100 to 150 feet.

Description: The rocket has a thin steel head to give the maximum blast effect. The propellant is the single unperforated cruciform Grain Mk 10. The body can be fitted with any one of a number of rocket motors to give velocities from 175 to 400 ft./sec. The mean lateral deviation is 10 mils from a 90-inch launcher.

The Base Fuzes Mk 146 and Mk 161 Mod 0 are armed during flight by the pressure of the gas evolved from the burning propellant acting on the diaphragm. The Head Mk 10 Mod 1 is the Head Mk 10, slightly altered to accommodate the new motor adapter of the Base Fuze Mk 161 Mod 0.

Remarks: The Army designates the Head Mk 10 or Mk 10 Mod 1 as the T37.

A smoke-filled round used by the Army is the same size, and has the designation of T88. It is nose-fuzed with either the Fuze Mk 152 or the Fuze Mk 141.

The Head Mk 5 may take either the Booster Mk 1 or the Booster Mk 2; the Head Mk 10, only the Booster Mk 1.

The Heads Mk 5 are loaded with TNT; the Heads Mk 10 may also take a TNT load.

7.2-inch C.W.R.–N. and M25, M27, and T24

	Motor Mk 5 and Head Mk 7
Over-all length, inches	48.1
Head width, inches	7.2
Head length, inches	18.75
Motor length, inches	29.0
Propellant (ballistite)	Grain Mk 11
Filler	Any chemical filler with specific gravity over 1.2.
Filler (F.S.), pounds	19.7
Total weight, pounds	53.2
Range, yards	3,500
Fuzing	Nose: Mk 147 or Mk 147 Mod 1

General: This rocket is fired from a 24-rail demountable, variable-elevation launcher carried in a 2½-ton truck. The salvo is fired in 2½ seconds, and the launcher can be reloaded in 1½ minutes.

These rockets of Navy design are under production by the Army. The only essential difference between the rockets as used by the Army and the Navy is in the propellant.

Head: The container is a bulb-shaped steel tube open at both ends. The adapter fits inside the flange on the forward end of the container and is brazed thereto. The wide forward end of the adapter is internally threaded to seat the fuze. The burster tube, made of steel, fits inside the adapter and extends downward into the container. The tube and adapter are held together by a press fit and sealed with white-lead paste. The rear end of the tube is closed.

Motor: The motor is a steel tube, with the forward end externally threaded to screw into the connector of the head. The nozzle is slipped down through the open end of the motor body, and the end is welded to the inner edge of the motor-body rim.

Tail: The tail assembly has four tail vanes spot-welded in pairs to the motor tube and spot-welded to the rear shroud. The forward shroud is riveted to the vanes but insulated from them. Four large fins are welded to the motor tube, pass over the forward shroud, and are welded to the rear shroud. The lead wires are connected to the two shrouds which serve as contacts.

Propellant: As produced for the Navy, the propellant consists of a single grain of solventless extruded ballistite with an outer diameter of 2.5 inches and an inner diameter of 1.0 inch. This is the Grain Mk 11.

In the Army Chemical Rocket M25, the propellant consists of four sticks of ballistite, with a one-inch axial hole, placed end to end with separating washers between the sticks. The sticks are three-ridged, and each has eight sets of holes radially through it. The over-all length of the sticks is 20.5 inches.

Remarks: The Army Rocket M27 is structurally the same as the Navy rocket, but is filled with C/K gas. Its total weight is 51.8 pounds.

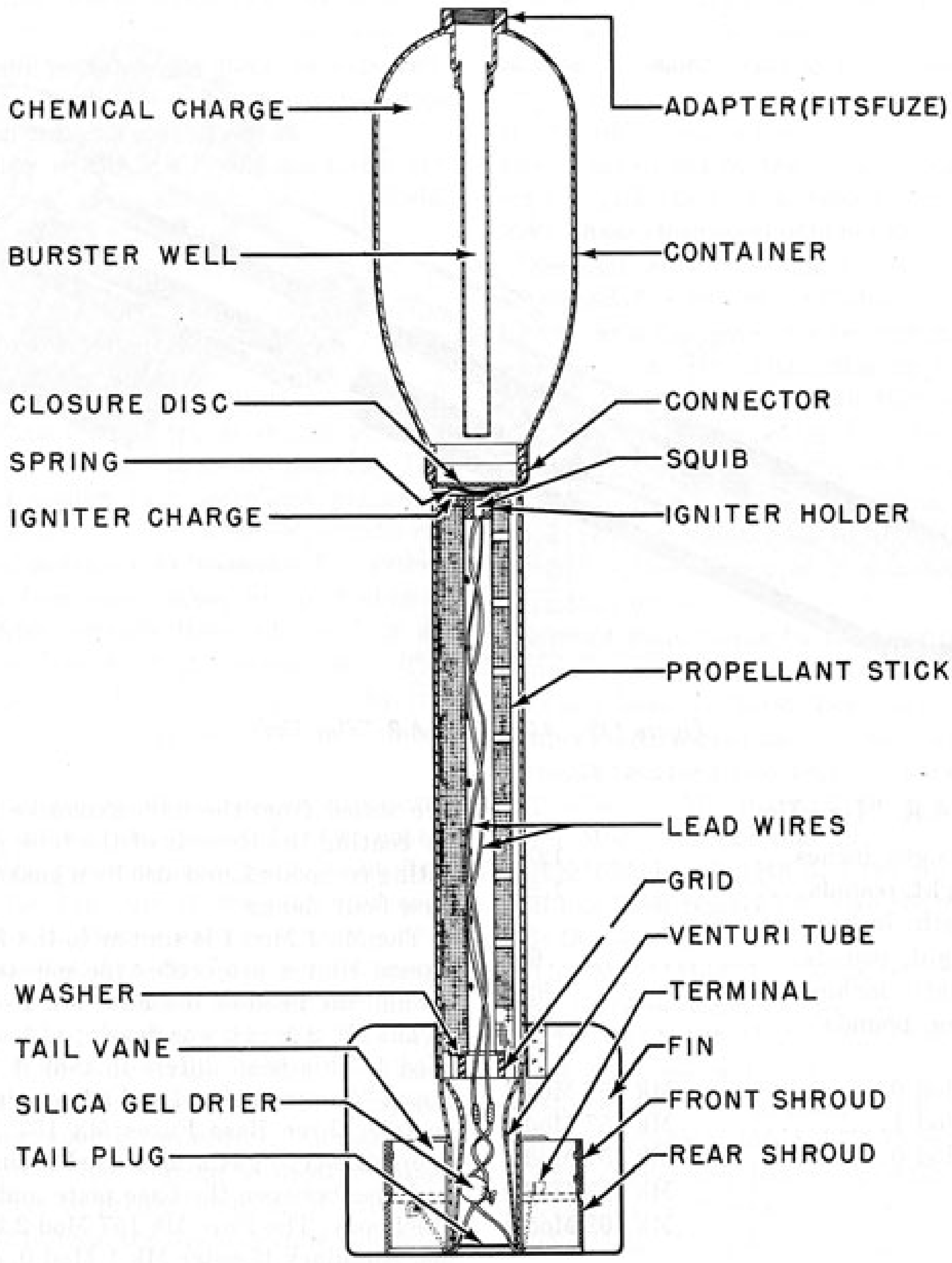


Figure 138. 7.2-inch C.W.R.-N. and M25 and M27

A head similar to the Mk 7 but loaded with 22 pounds of TNT and equipped with a booster instead of a burster tube is known as the Mk 9. It is a demolition head, using the Fuze Mk 137 and the 3.25-inch Motor Mk 5. This combination may be used to lay down a barrage from the same launchers as the C.W.R.-N.

When the Head Mk 9 is fuzed with the Fuze Mk 147, it is known as the Round T24. Its total weight is 51.8 pounds.

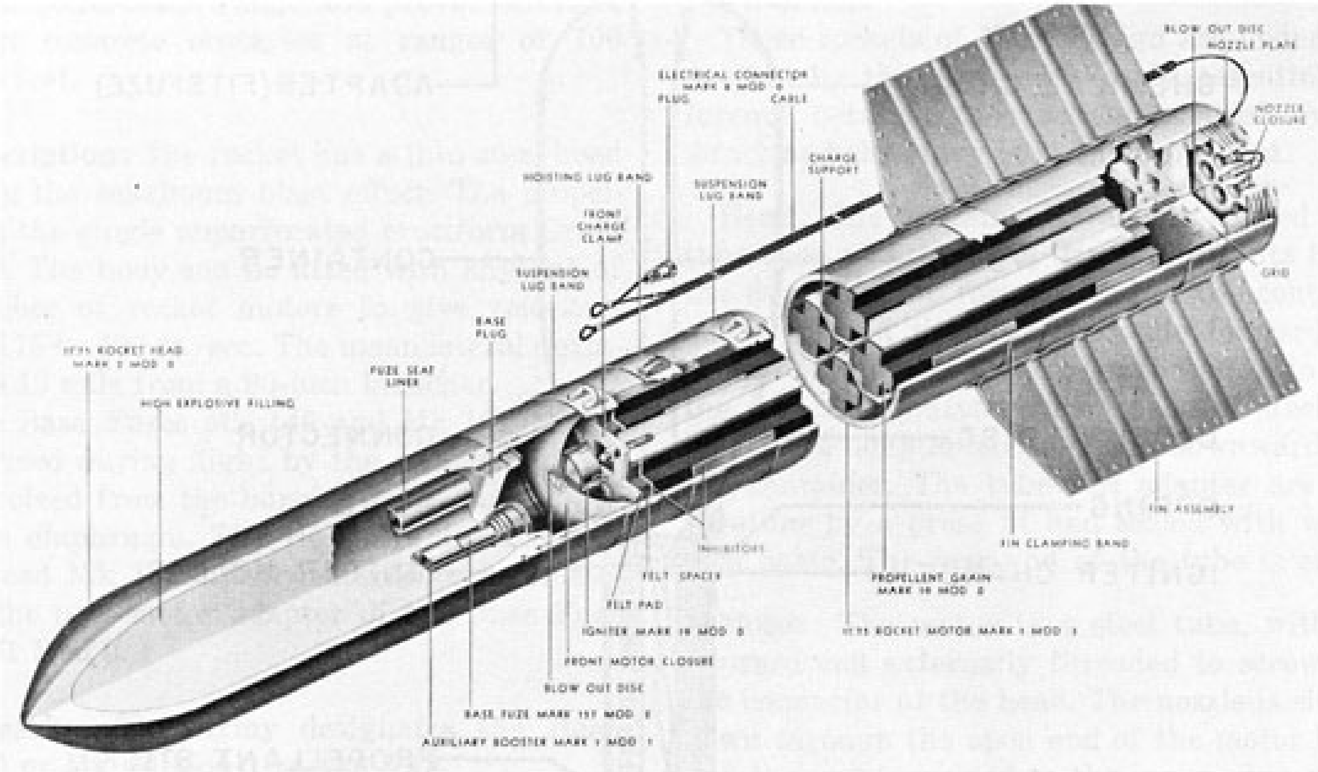


Figure 139. 11.75–inch A.R. "Tiny Tim"

11.75-inch A.R. "Tiny Tim"

Over-all length, inches	123.0
Total weight, pounds	1,253
Head length, inches	47
Head weight, pounds	600
Motor length, inches	82.4
TNT filling, pounds	152.5
Fuzes	
Mk 1 Mod 0	Mk 157 Mod 1
Mk 1 Mod 1	Mk 157 Mod 2
Mk 2 Mod 0	Mk 157 Mod 2
	Mk 163 Mod 0
	Mk 162 Mod 0

Heads: The Mk 1 Mod 0 consists of a standard 500-lb. S.A.P. Bomb AN–M58A1 modified for this particular use. The changes include the removal of the suspension lugs, an increase in the number of threads securing the base plate, the use of a new base plug to take the Fuze Mk 157 Mod 1, and the use of an adapter ring welded around the after end as a means for attaching the rocket motor. The motor gases are sealed from the high explosive in the body by coating the threads of the base plate with a luting compound, and also by a gasket under the fuze body flange.

The Mk 1 Mod 1 is similar to the Mk 1 Mod 0, except that a projectile-type gas seal is added around the head of the Fuze Mk 157 Mod 2.

The Mk 2 Mod 0 was developed from the Mk 1 Mod 1. This head differs in that it has a solid-nosed "Common" head and a base plate modified to take three Base Fuzes Mk 157 Mod 2. The projectile-type gas seal is used around all fuzes and also between the base plate and the forged steel body. The Fuze Mk 157 Mod 2 is used with one Auxiliary Booster Mk 1 Mod 0, or the Fuze Mk 163 Mod 0 with one Auxiliary Booster Mk 19 Mod 0.

The Head Mk 3 Mod 1 was issued for practice to simulate the Head Mk 2 Mod 0.

The Head Mk 4 Mod 0 is slightly lighter and shorter than previous heads. The head weight is 578 pounds, including 152 pounds of TNT. The head length is 46 inches. Three Fuzes Mk 163 Mod 0 or Mk 162 Mod 0 are used in the base.

The penetrative characteristics of this head are the same as those of present types, but slightly better over-all performance may be expected, because of the small increase in velocity resulting from reduction in total weight.

The Practice Head Mk 5 dummies the Mk 4. It is 44.75 inches long and weighs 569 pounds. It has a cavity for a smoke puff.

The heads are shipped loaded and fuzed. A cuff protects the threads on the adapter ring and the fuze during shipment.

Motors: The Mk 1 Mod 0 consists of a steel tube, the after end of which is threaded to receive a plate having twenty-five nozzles. The motor tube contains four propellant grains of solventless extruded ballistite of cruciform cross-section, weighing 147 pounds. The grains are shielded from each other by an X-shaped partition which extends longitudinally for almost the full length of the motor tube. The grains and the partition are supported by the grid and are strapped together by aluminum bands.

In normal operation, the gases from the burning powder do not pass through the central nozzle, which is closed by a copper blowout disc. Only when the pressure in the motor exceeds approximately 22,500 pounds per square inch is this disc expelled, bringing the central nozzle into operation. The use of a blowout disc allows the rocket motor to perform satisfactorily over a greater temperature range. It has one disadvantage, however, in that at motor temperatures of about 100° F., where the normal operating pressure is just enough to shear the disc, it is impossible to predict whether it will blow out or not. If it does, the burning time is lengthened and the gravity drop is increased, so that the rocket may miss the target.

Four black-powder charges of about 0.5 pound each, contained in plastic cases at the front ends of the grains, provide the ignition for the propellant. They are set off by two small electric squibs in each case, which are connected to receptacles in the nozzle plate. The burning of the propellant is markedly affected by its moisture content. Consequently, the motors are sealed at both ends. Each of the 24 peripheral nozzles is sealed with a thin steel cup. The front end is sealed with a thin steel disc having in its center a small blowout window. This window is blown out by the motor pressure, allowing the propellant gases free access to the base fuze. These closures should not be removed.

The Igniter Mk 19 Mod 0 has recently been developed for use in 11.75-inch A.R. motors. Known as a tin-plate case igniter, it consists of a single metal case 3.38 inches in diameter and 1.8 inches deep, with a wall thickness of 0.01 inch. Four clips are soldered to the base of the case, for attachment to the motor charge support. The case contains 230 grams of F.F.F.G. black powder. Contained in the case are two electric squibs connected in parallel to the igniter lead wires.

Motors must never be fired above the rated temperature stencilled on the motor, because they are likely to burst. Below the lower rated temperature, occasional ignition failures and interrupted burning may be experienced.

The Motor Mk 1 Mod 1 is identical to the Mk 1 Mod 0, except that the motor tube is of higher tensile strength and the pigtail connection has been replaced by two receptacles built into the base plate.

The Mk 1 Mod 2 is a design in which the dead space between the forward motor closure and the base of the rocket head has been eliminated. This motor is similar in other respects to the Mk 1 Mod 0, except that the over-all length has been reduced to 75.75 inches and the pigtail connection has been replaced by two receptacles built into the base plate.

The Motor Mk 1 Mod 3 is the Bureau of Ordnance production of the Mk 1 Mod 2.

The Motor Mk 2 Mod 0 weighs 600 pounds and is 72.04 inches in length. Length and weight reduction have been accomplished by improvements in design detail, so that the total amount of propellant in the motor has not been changed. Because of design and construction changes, the Motor Mk 2 Mod 0 may be used only with the Head Mk 4 Mod 0.

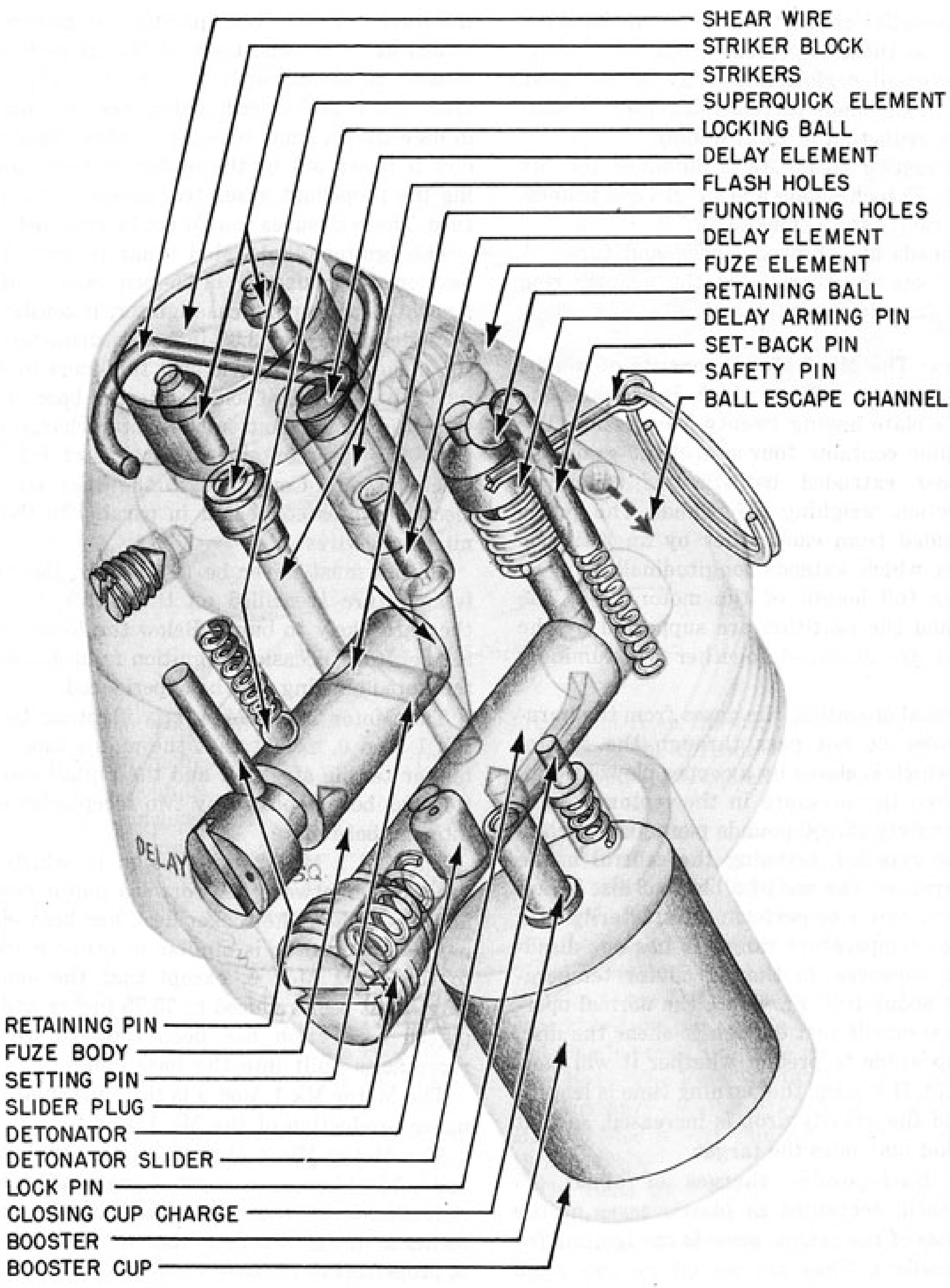


Figure 140. Army Nose Fuze (Rocket) M4A2

Part 2 — Chapter 6

ROCKET FUZES

Section 1 — INTRODUCTION

General

Because rocket ballistics have something in common with the ballistics of both projectiles and bombs, their fuze design has borrowed from both of these, and has also initiated devices from its own province, such as using motor gas pressure to arm base fuzes, etc.

The development of rockets during the war was rapid, and adaptations were sometimes thrown into the breech which will now be replaced by more efficient mechanisms. At present, however, there is a great variety of rocket fuzes available.

Dummy fuzes

The Army uses inert or dummy fuzes in its practice rounds. They are designated by different numbers than those on their corresponding service fuzes.

Section 2 — ARMY NOSE FUZES

M4A2 (Discontinued)

Rocket used in	4.5-inch H.E. M8
Functioning	For air, 0.015 sec. delay or instantaneous For ground, 0.1 sec. delay or instantaneous
Arming time	When forward acceleration ceases
Body diameter, inches	3.21
Over-all length, inches	2.51 (without booster)

General: The Fuze M4A2 has been designed to be bore safe for firing from launcher tubes on aircraft or from the ground. There are two different issues of the fuze, identical except for the delay time, which is slightly less in the rockets fired from aircraft because of the increased velocity of those rockets as compared to rockets fired from ground launchers.

Operation: Before the rocket is loaded on the launcher, the fuze is set for either instantaneous (super-quick) action or delay action as desired. This is accomplished by rotating the setting pin. For instantaneous action, the pin is rotated so that the functioning hole (flash channel) in the setting pin mates with the flash hole from the super-quick element. For delay action, the setting pin is rotated 180 degrees, so that the flash hole from the super-quick element is obstructed and the delay firing channel is the only one open. In either position, the setting pin is secured by the spring-loaded locking ball fitting into either of two recesses in the setting pin. The cotter pin is then removed, so that the set-back pin will be free to move back on set-back.

When the rocket is fired, acceleration causes the set-back pin to move rearward, the spring offering sufficient resistance so that the pin reaches its most rearward position only after the rocket has cleared the launcher. This frees the retaining ball to be forced into an escape hole by the spring-loaded delay arming pin as deceleration sets in. As the lower end of the delay arming pin clears the inner end of the detonator slider, the slider is moved over to the armed position by the slider spring. The spring-loaded lock pin rides in a keyway on the

underside of the slider and snaps into a recess when the slider reaches the armed position. The firing train is now lined up. On impact, the head of the fuze is crushed, the shear wire is sheared, and both strikers are driven inward, initiating both primers. Thus, both the super-quick and the delay elements are ignited, irrespective of the setting of the fuze. If set for instantaneous action, the flash from the super-quick element ignites the detonator before the delay element functions. If set for delay, the flash from the super-quick element will be obstructed by the setting pin and the flash from the delay element will ignite the detonator 0.015 second later if used in an aircraft-launched rocket, 0.1 second later if used in a ground-launched rocket.

Early designs: The M4A1 had a longer setting pin, with double flash holes, so that the flash from either the super-quick or the delay elements had to pass through the setting pin. Hence, if the setting pin was not rotated to exactly the proper point where the setting-pin flash holes matched with those from the initiating elements, the fuze would not function. In the M4A2, this condition was remedied by the shorter setting pin, so that, even if the pin is not rotated to match with the flash hole from the super-quick element, the delay flash hole will permit firing of the fuze after the slight delay. The M4A1 also had a heavier detonator slider, which occasionally sheared the lock pin and did not stay properly lined up in the armed condition. The M4A2 has a lighter, aluminum slider detonator.

The original M4 had only one issue for both ground- and aircraft-launched rockets with either instantaneous or 0.1-sec. delay settings. The M4A1 had two issues, with either 0.015-second or 0.1-second delays and instantaneous settings. The original M4 also had thicker walls and was consequently heavier, and had stronger springs under the set-back pin and delay arming pin, requiring greater acceleration to arm.

M81, M48A2, or M51

Rockets used in	4.5-inch Spin
Functioning	Instantaneous or 0.05 sec. delay
Over-all length, inches	4.55
Weight, pounds	1.41
Threads	14 N.S.–1

General: The Fuze M81 consists of the Artillery Fuze M48A2 assembled with either the Booster M21A1 or the Booster M24. Depending on where the fuze is assembled, it may be marked M81, M48A2, or M51. Only the 0.05-second delay models of the M48A2 fuzes are loaded in rockets at present.

Description: Much like the Navy's Fuze Mk 29 or Mk 30 in construction, this fuze adds a delay firing train. The choice of instantaneous (super-quick) or delay firing is made on the selector sleeve of the interrupter device—the slot being set parallel to the longitudinal axis of the fuze, or within 15 degrees either side, for super-quick action, and at right angles thereto for delay action.

The interruptor sleeve is thicker on one side than on the other. When set for "Delay," the thick side holds the interruptor in the flash channel, blocking any flash through that tube. When the sleeve is set for "Super-quick," the thin side of the sleeve allows the interruptor to move up into the sleeve by centrifugal stimulus, clearing the flash channel.

The instantaneous action is like that described for the Mk 29. The delay firing train is a separate unit in the base of the fuze. There are two plunger pins or centrifugal detents holding the delay assembly in the unarmed position. When the fuze is armed, there is a firing pin positioned over a primer, which leads to a black-powder delay, and, in turn to a flash pellet.

Operation: No action takes place upon firing until sufficient rotational speed has been established to overcome the resistance of springs and set-back force on the several safety devices. When the fuze is set for super-quick action, after it leaves the muzzle, centrifugal force causes the interruptor to move outward, opening the passage. At the same time, the plunger pins locking the delay assembly in the unarmed position also move outward, releasing that assembly in preparation for impact. The

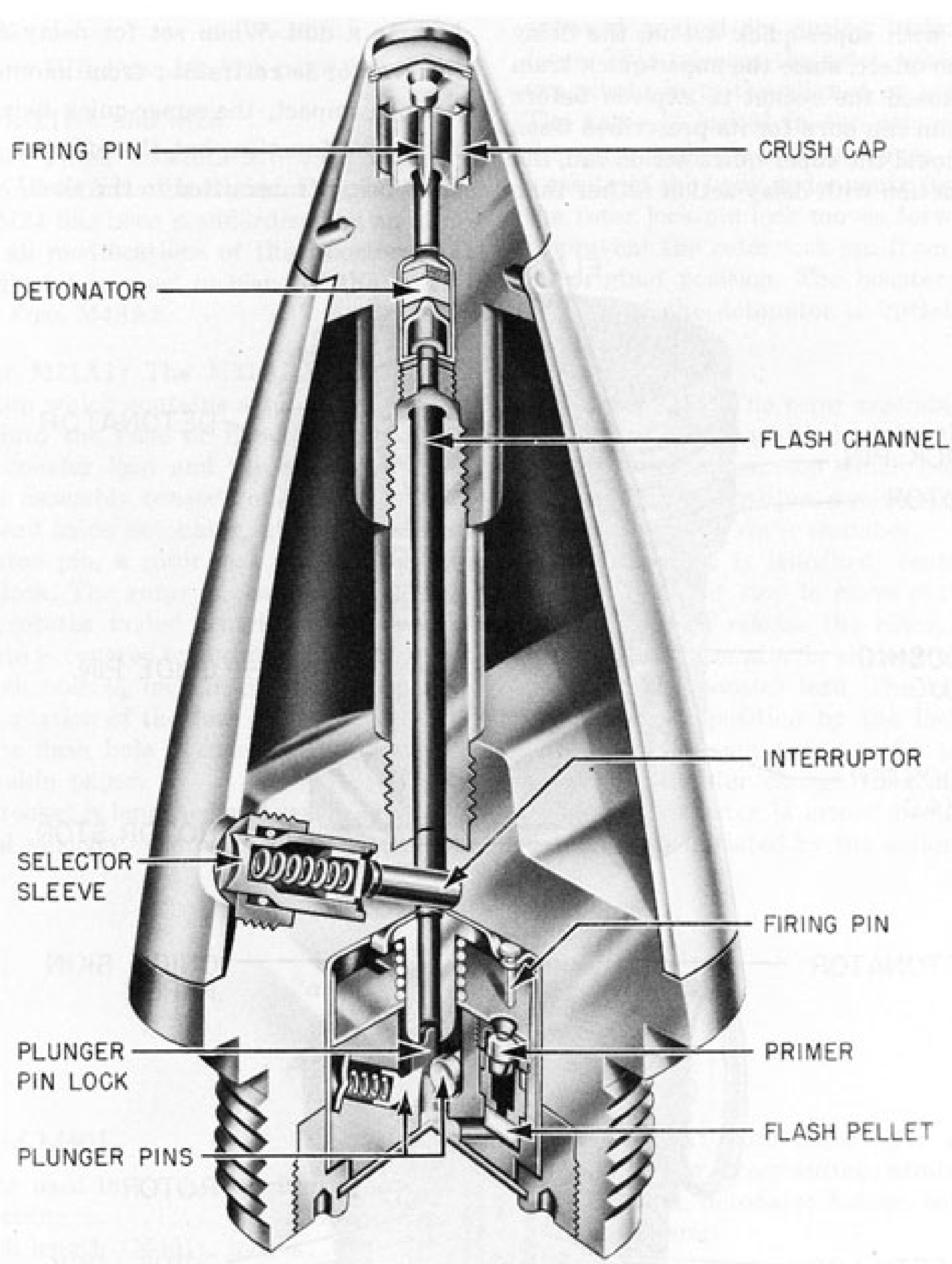


Figure 141. Army Nose Fuze (Rocket) M48A2

plunger-pin lock then swings on its pivot under centrifugal force, placing an arm against the inner end of each plunger pin, preventing the return of the pins to the unarmed position. Upon impact, the firing pin of the super-quick action is driven against the detonator, initiating the super-quick action. Inertia causes the delay-action plunger to move forward, driving the primer against the delay-action firing pin and initiating the delay action. In normal

functioning with super-quick action, the delay action has no effect, since the super-quick train will have caused the rocket to explode before the delay train can burn for its prescribed time. However, should the super-quick action fail, the fuze will function with delay action rather than become a dud. When set for delay action, the interruptor is restrained from moving.

Upon impact, the super-quick firing pin and detonator function, but the effect is prevented from being transmitted to the shell.

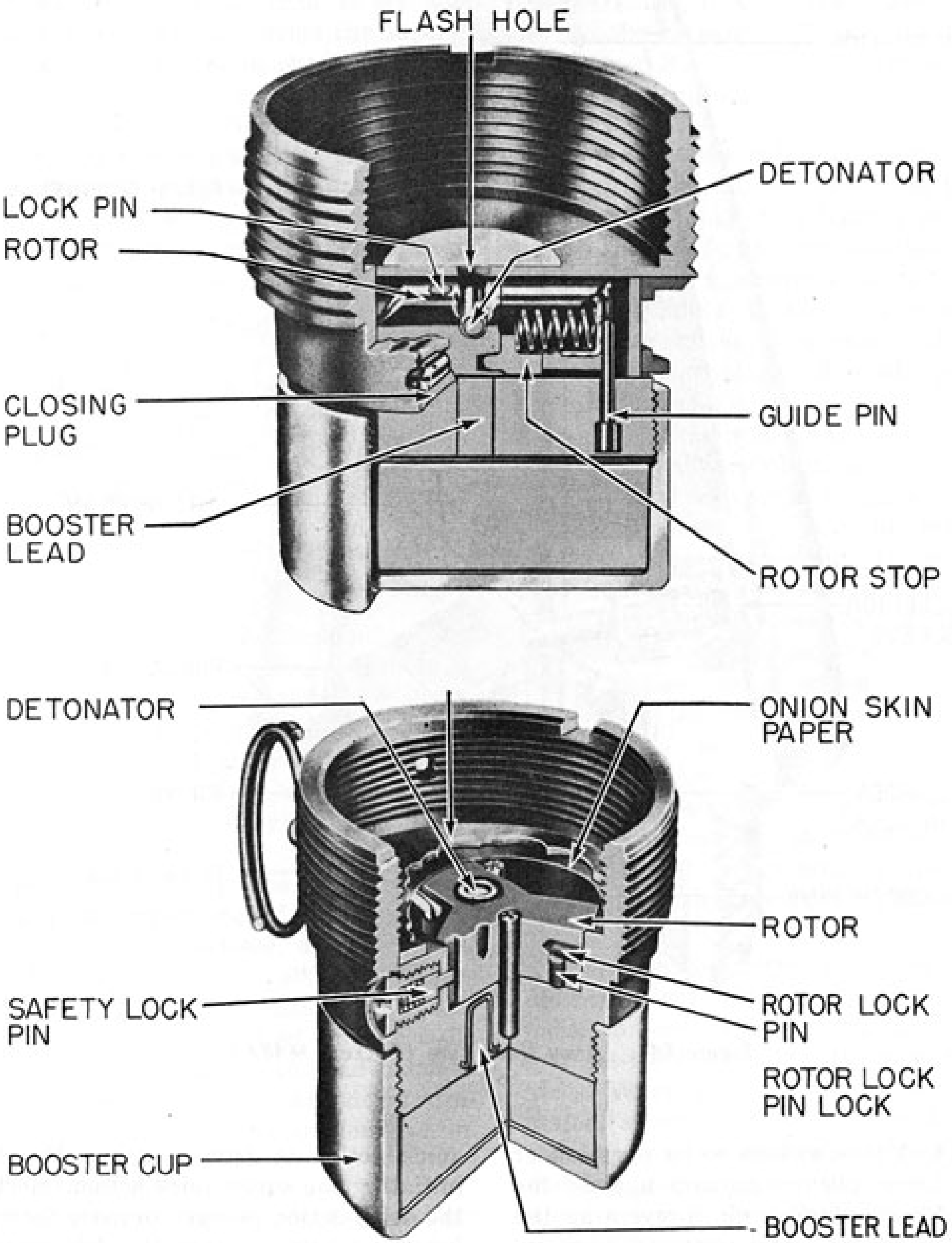


Figure 142. Boosters M24 (above) and M21A1 (below)

V.T. M402

See Navy V.T. Fuze Mk 170, page 209.

Boosters M21A1 and M24

General: These boosters are used with the Fuze M48A2 to form the Rocket Fuse M81. The Booster M24 has been standardized as an alternate for all modifications of the Boosters M21 Type and may be used in place of the M21A1 with the Fuze M48A2.

Booster M21A1: The M21A1 consists of a booster cup which contains a tetryl charge and threads into the base of the body containing a tetryl booster lead and the rotor assembly. The rotor assembly consists of a rotor containing the lead azide detonator, a safety lock pin, a rotor stop pin, a rotor lock pin, and a rotor lock-pin lock. The rotor is seated on the pivot pin and rotates under centrifugal force. The mechanism is covered by a thin brass disc which has a flash hole 1/4 inch in diameter to permit the transmission of the fuze action to the detonator. The flash hole is covered by a thin disc of onion-skin paper.

When rocket is launched and reaches required rotational velocity, the safety lock pin moves outward against its spring under centrifugal force. This releases the rotor, which rotates on the pivot pin to the aligned or armed position. The rotor is locked in the armed position by the rotor lock pin, which moves outward into a cavity of the body under centrifugal force, and the rotor lock-pin lock moves forward by creep to prevent the rotor lock pin from returning to its original position. The booster is armed in flight, and the detonator is initiated by action of the fuze.

Booster M24: The rotor assembly of the M24 consists of a rotor which contains the detonator, a centrifugal rotor stop which holds the rotor in the unarmed position, a guide pin, and a plate which closes the rotor chamber.

When rocket is launched, centrifugal force causes the rotor stop to move outward against the spring and release the rotor, which turns so that the detonator is aligned with the flash hole and the booster lead. The rotor is locked in the armed position by the lock pin, which enters the lock pin cavity as far as the closing plug. The booster charge consists of a tetryl pellet. The booster is armed in flight, and the detonator is initiated by the action of the fuze.

Part 2 — Chapter 6 — Section 3

ARMY BASE FUZES (SERVICE)

M400 and M401

Rockets used in	2.36-inch rounds
Functioning	Instantaneous
Over-all length (M401), inches	2.58

General: These fuzes are similar in operation, the differences being in the dimensions and arrangement of the parts. Also, the M400 has a striker guide which is not in the M401. Both these fuzes are considerably safer to handle than the original base fuze in the 2.36-inch rockets, a fuze which had only a safety pin and detonator cover for safety devices.

Description: Both fuzes have a housing, or body, a striker, creep spring, arming pin, slider, slider spring, detonator holder, safety pin, and shipping clamp.

Operation: The shipping clamp can be unlatched and removed when the safety pin is taken out, before loading in the launcher. On set-back, the slider moves back against its spring, which action frees the arming pin from the binding action of the slider. The arming pin is now riding against the inside of the launcher, and, when the round leaves the launcher, the arming pin is shot out by its

spring. The firing pin is now held by only the creep spring. On an impact equivalent to a 12-foot drop, it will overcome the spring to strike the detonator.

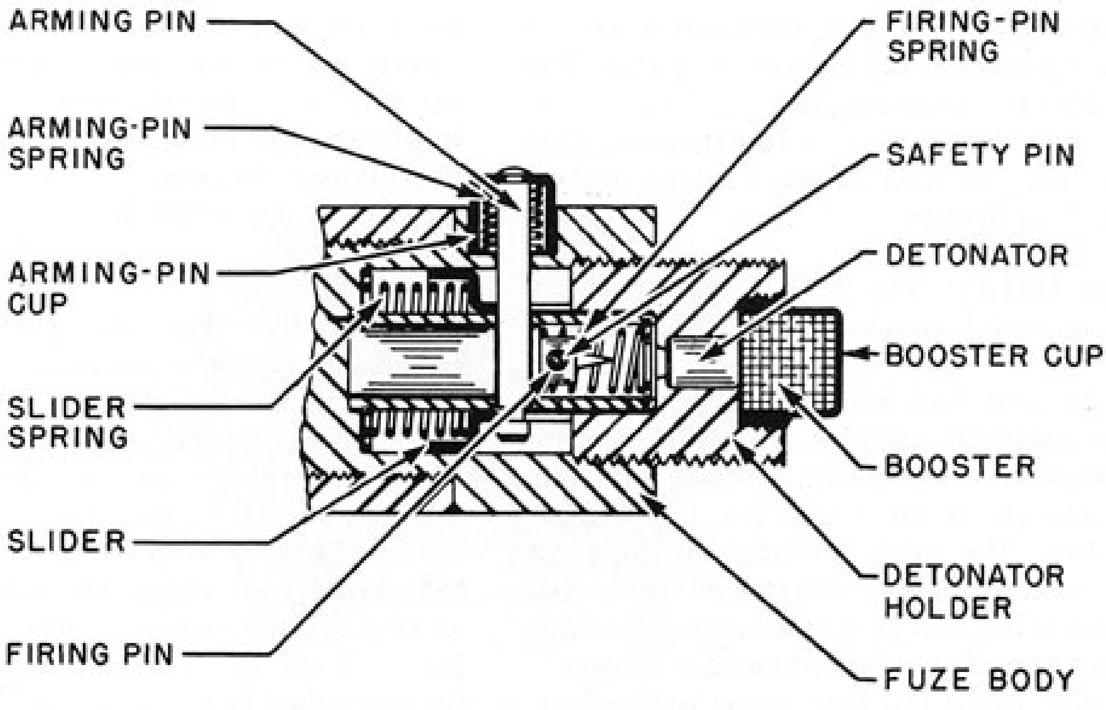


Figure 143. Army Base Fuze (Rocket) M400

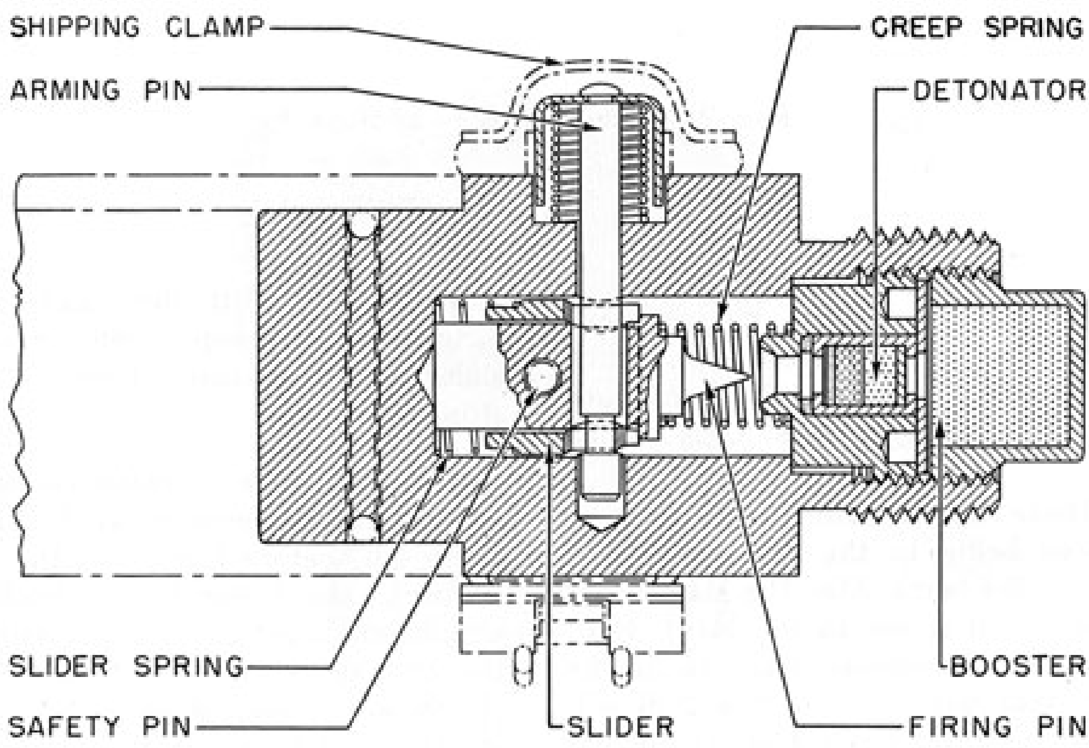


Figure 144. Army Base Fuze (Rocket) M401

ARMY BASE FUZES (EXPERIMENTAL TYPES)

T156

Rockets used in..........4.5-inch S.A.P. T78
Weight, pounds..........................1.39
Over-all length, inches..................2.81
Diameter, inches 2.3
Functioning.....0.01-second delay on impact

General: The T156 is a modification of the Artillery Fuze M68, without the tracer and with the retaining spring holding the firing pin block. Also the safety washer is 0.02 inch rather than 0.04 inch thick as in the M68.

Description and operation: The retaining spring, which is slotted and fits around the neck of the firing-pin block, holds the firing-pin block in a safe position, until the spring is removed by the pull ring before affixing the motor to the rocket head. The expansion plug acts to hold the spring in place during shipment.

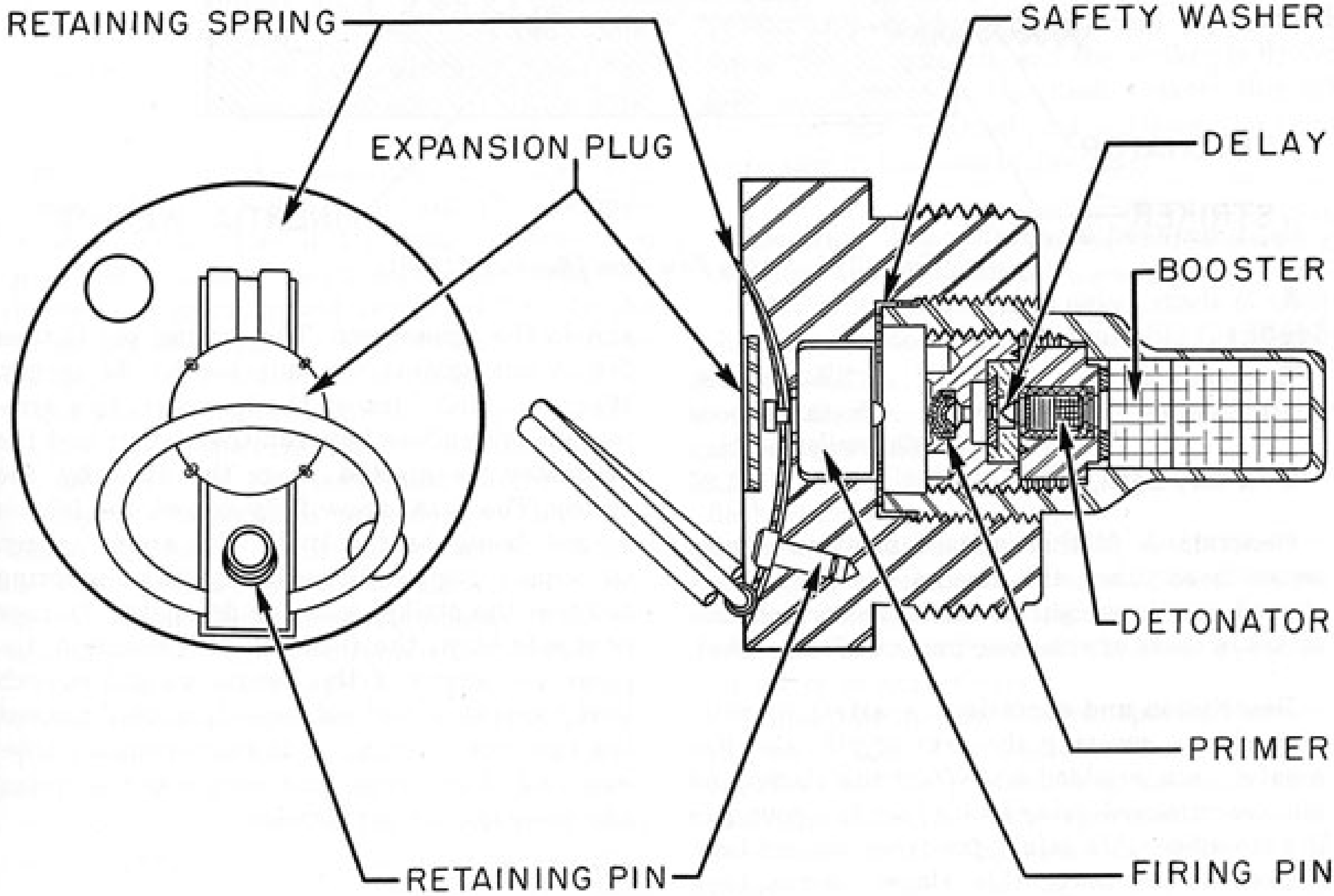


Figure 145. Army Base Fuze (Rocket) T156

On impact of the rocket, the firing-pin block is forced down by inertia on the safety washer, a thin aluminum disc, bending the washer, and striking the primer. The primer sets off the delay pellet (0.01-second) and then the detonator, which, in turn, explodes the booster charge of tetryl.

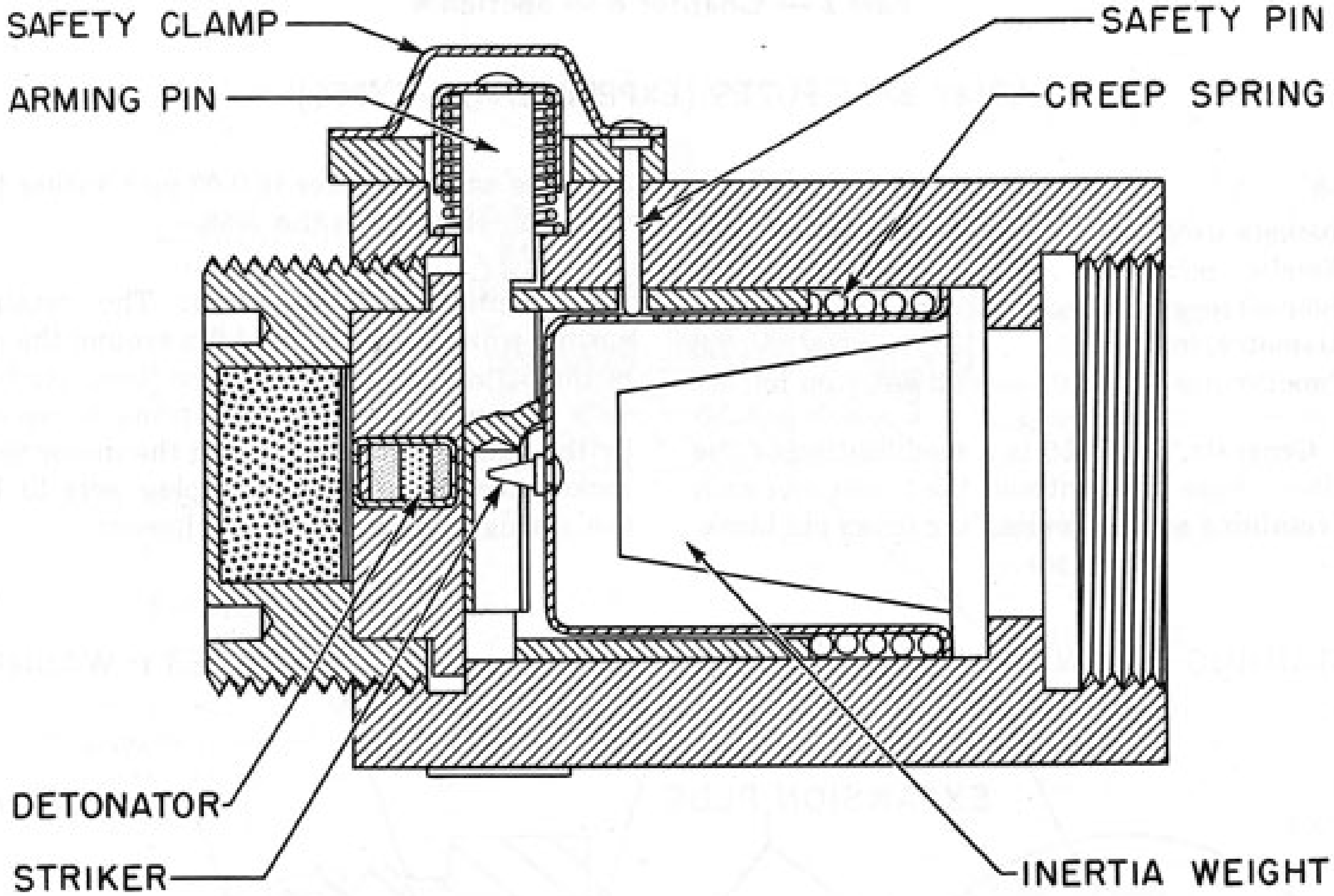


Figure 146. Army Base Fuze (Rocket) T160E1

T160E1

Rockets used in................3.5-inch T80
Functioning ....Instantaneous (All-ways-action)
Over-all length, inches..................3.26

General: A further advancement in simple rocket base fuzes, this design has the wedge-shaped inertia weight to facilitate correct fuze action in cases of side-wise impact of the rocket.

Description and operation: A safety or shipping clamp, covering the arming pin, also has a safety pin bradded on. When the clamp and pin are removed prior to loading the round in the launcher, this safety pin frees the set-back sleeve. On set-back, this sleeve moves back against the creep spring, and comes out of its slot in the arming pin. The arming pin is then forced out against the launcher by its spring. When the round leaves the launcher, this arming pin, which was between the striker and the detonator, is ejected from the fuze by the spring. The fuze is now fully armed, the inertia weight being held only by the creep spring. On impact, the weight moves against the spring to force the striker into the detonator. In case of a side blow, the fuze will still function, because the shape of the inertia weight is such that a side blow will not cause it to bind against the fuze body, but gives it room to move sidewise and at the same time compress the spring and move the striker forward.

T2004 V.T.

See Navy V.T. Fuze Mk 172, page 213.

NAVY NOSE FUZES

Mk 29 Mods 0—3

Rockets used in......5-inch Mk 10 and Mods
Functioning ....Instantaneous
Fuzes found with....................None
Arming speed, r.p.m...........1,500—2,000
Diameter, inches.......................3.0
Over-all length, inches.................4.15
Weight, pounds..................1.45–0.04

General: The Nose Fuze Mk 29 is used in both projectiles and the 5-inch spin-stabilized rocket. It functions on impact, with no delay.

Description: The fuze consists of four principal parts: (1) the base, which contains the relay detonator and holder and the interruptor unit; (2) the nose or detonator assembly, which contains the striker assembly and the detonator; (3) the plastic ogive; and (4) the flash tube, which is fitted in the center of the ogive and holds the nose and the base together. The firing-pin supporting cup is located beneath the firing pin, holding the striker away from the detonator, and a centrifugal interruptor separates the detonator from the relay detonator in the base of the fuze. Two types of interruptor assemblies have been employed. In the earlier model, the interruptor bore against the upper blade of a forked setting sleeve in the "Delay" or "Off" position and thus could not move into the sleeve and clear the flash channel. Rotating the sleeve 90° in either direction to the "S.Q." or "On" position removed the end of the forked blade from the interruptor, and centrifugal force could move the interruptor into the sleeve and out of the flash channel. The interruptor system of later models has been slightly altered. A cylindrical setting sleeve with an eccentric bore is employed. In the "Delay" or "Off" position, the eccentric bore is not aligned with the interruptor, and the interruptor cannot move into the sleeve and clear the channel. Turning the setting sleeve to the "S.Q." or "On" position aligns the bore with the interruptor, which can then be moved into the sleeve by centrifugal force.

Operation: When the fuzed rocket is loaded into the launcher, the setting key is turned to the "On" or "S.Q." position. When the rocket leaves the gun, centrifugal force moves the interruptor into the sleeve and clears the flash channel. On impact, the closing disc above the striker is forced down, the crush cup beneath the striker is crushed, and the striker is driven into the detonator. The flash travels through the open flash channel and initiates the relay detonator in the base of the fuze.

Remarks: The differences between Mods of this fuze are as follows:

No Mod—Dark green ogive, made of easily chipped asbestos plastic, unsuitable for storage and handling.

Mod 1 — Chip-proof, resin-impregnated cloth, yellow plastic ogive.

Mod 2—Same as Mod 1, with strengthened flash channel.

Mod 3—Like Mod 2, with longer nose cap extending to base and giving additional support to flash channel. Brown plastic ogive.

This fuze will function on thin plate and on water at angles over 6°.

A disc 0.01 inch thick is incorporated between the relay detonator and the flash channel of the Mod 3. This prevents gas pressure, which sometimes leaks past the unarmed interruptor, from setting off the relay detonator, if the nose of the fuze is accidentally struck during handling.

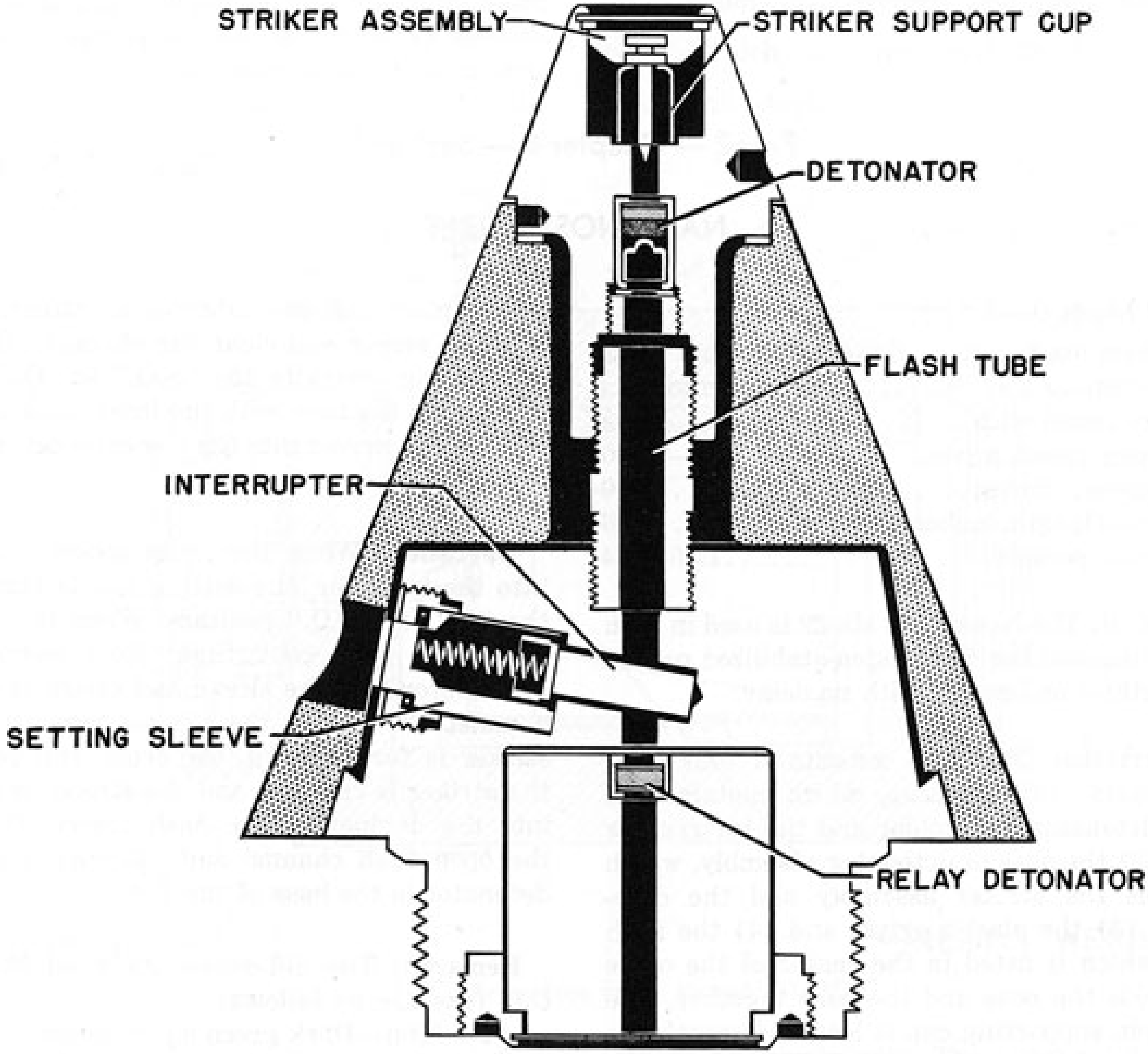


Figure 147. Navy Nose Fuze (Rocket) Mk 29 Type

Mk 30 Mods 3 and 4

Rockets used in	5.0-inch Head Mk 10
Functioning	Instantaneous
Arming speed, r.p.m.	1,500—2,000
Body diameter, inches	2.4
Over-all length, inches	4.55
Weight, pounds	1.51

General: The Nose Fuze Mk 30 Mod 3 is the point-detonating projectile fuze. It is armed by creep and centrifugal force and used in spin-stabilized rockets. The fuze is designed to function on impact with super-quick action.

Description: The fuze consists of the same principal parts as are in the Mk 29. The fuze is designed for super-quick action on impact. The "Off" setting is a safety feature to prevent premature detonation, and the setting sleeve must be turned to "S.Q." or "On" before the rocket is launched. When the rocket is launched, the interruptor moves outward by creep and centrifugal force to compress the spring and open the flash tube. On impact, the gilded metal cap collapses and the striker is driven into the detonator, the flash of which initiates the relay detonator and the main charge.

Mod 4: Because of inability to procure sufficient plastic ogives for the Point-Detonating Fuze Mk 30 Mod 3, it was necessary to use quantities of steel ogives. These fuzes with steel ogives, designated as Nose Fuzes Mk 30 Mod 4, will be restricted to rockets.

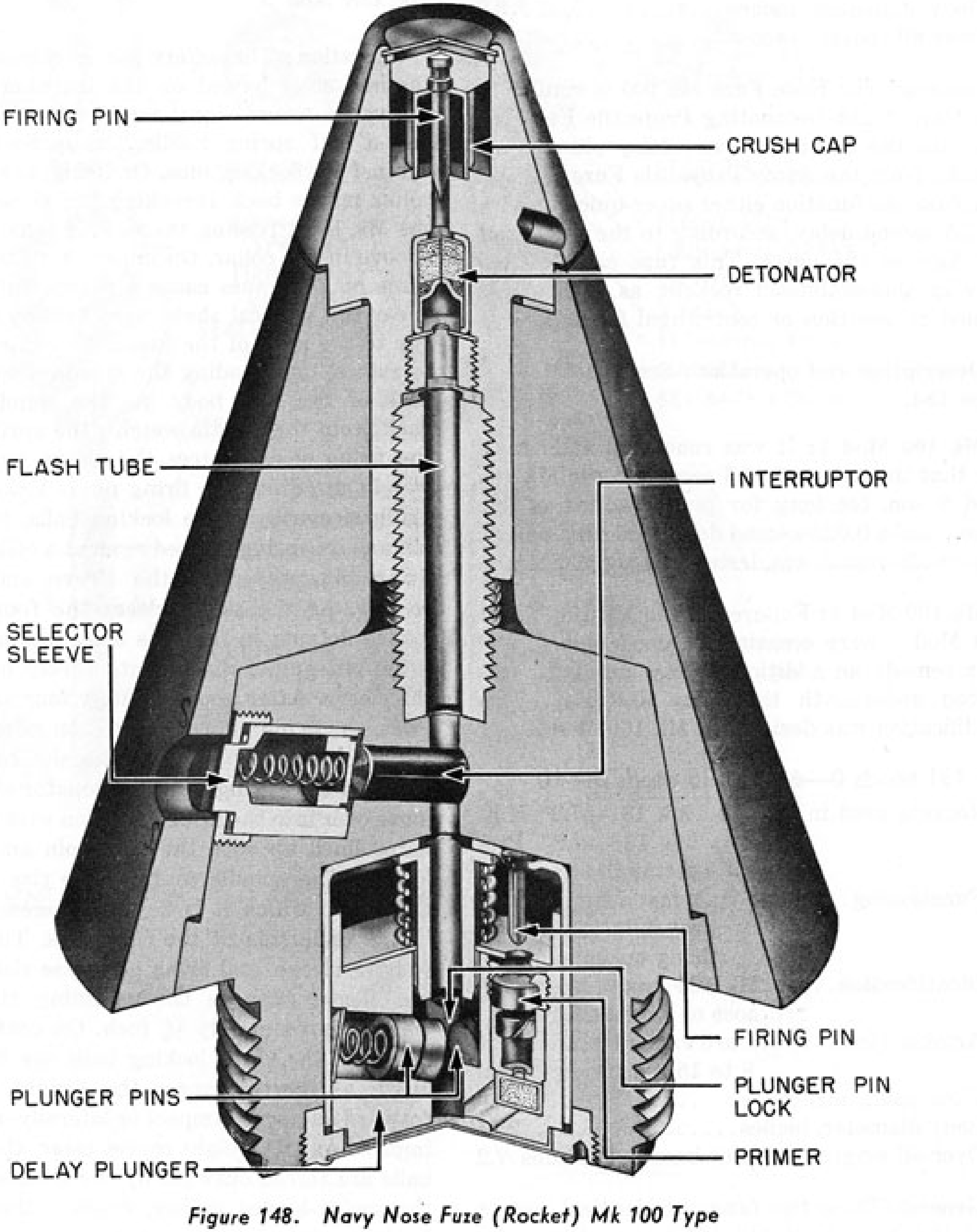


Figure 148. Navy Nose Fuze (Rocket) Mk 100 Type

Mk 100 Mods 0—2

Rockets used in . . . . 5.0-inch Mk 7 S.S.
Functioning . . . . Instantaneous or 0.05-second delay
Arming speed, r.p.m. 1,500-2,000
Body diameter, inches 3.0
Over-all length, inches 4.15

General: The Nose Fuze Mk 100 is similar to the Navy Point-Detonating Projectile Fuze Mk 29, with the addition of the delay plunger assembly from the Army Projectile Fuze M48A2. The fuze can function either super-quick or with a 0.05-second delay, according to the setting of the key on the ogive. This fuze can be used only in spin-stabilized rockets, as the fuze is armed by rotation or centrifugal force.

Description and operation: See Fuze M48A2, page 184.

Mk 100 Mod 1: It was concluded after testing that the delay of 0.05 second in the Mk 100 Mod 0 was too long for proper action of the round, and a 0.025-second delay was substituted. This modification was designated Mk 100 Mod 1.

Mk 100 Mod 2: Failures of the Mk 100 Mod 0 and Mod 1 were occasionally encountered, and as a remedy an additional relay detonator was placed underneath the delay assembly. This modification was designated Mk 100 Mod 2.

Mk 131 Mods 0—6, Mk 136 Mods 0—10

Rockets used in . . . . Mk 131—7.2″ H.E. Mk 136—7.2″ Projector Charge
Functioning . . . . Arms during water travel, instantaneous firing on impact
Identification . . . . . . Mk 131 has red paint on nose of vane hub
Arming Time . . . . . . 4 to 5 vane revolutions, or 8 to 15 feet water travel
Vane span, inches 3.125
Body diameter, inches 2.25
Over-all length (without booster), inches . 7.2

General: These two fuzes are identical, except that the Nose Fuze Mk 136 has a shear wire through the set-back collar. Both fuzes were to be replaced by the Nose Fuze Mk 140; however, this fuze is being recalled from the field. The Nose Fuze Mk 131 has been replaced by the Mk 156 and the Mk 136 has been replaced by the Mk 158 Mod 0.

Operation: The safety pin is removed when the rocket is loaded on the launcher, leaving the vanes secured by the set-back collar, which has a leaf spring holding it up by pressure against the locking pins. On firing, the set-back collar moves back (breaking the shear wire in the Mk 136), freeing the locking pins from the groove in the collar. On impact with water, the force on the vanes cause a torque sufficient to shear the vertical shear wire holding the vane cup to the neck of the fuze. The vanes are free to rotate, unthreading the spindle through the neck of the fuze body. As the spindle draws back from the inertia weight, the spring under the firing sleeve forces the sleeve and inertia weight up. Since the firing pin is locked to the firing sleeve by three locking balls, the firing pin and its spring, cocked against a collar on the firing pin, rise with the sleeve and inertia weight. As the sleeve clears the four spring-loaded detents in the fuze body just above the firing-pin guide, the detents spring out under the sleeve. After approximately four vane rotations, the firing pin will have been raised by the sleeve sufficiently to clear the shutter cavity, allowing the spring-loaded detonator shutter to move over into the armed position with the detonator lined up with the firing pin and booster lead-in. The spindle continues to rise until the washer to which it is keyed engages a groove in the underside of the fuze neck. The inertia weight, sleeve, and firing pin cease rising when the sleeve engages the retaining ring after rising approximately 1/4 inch. On contact with a target, the three locking balls are forced inward, as inertia causes the weight to move forward on normal impact or laterally on oblique impact. As the weight moves clear, the locking balls are forced outward by the beveled edge of the spring-loaded striker, which is then free to be driven into the detonator.

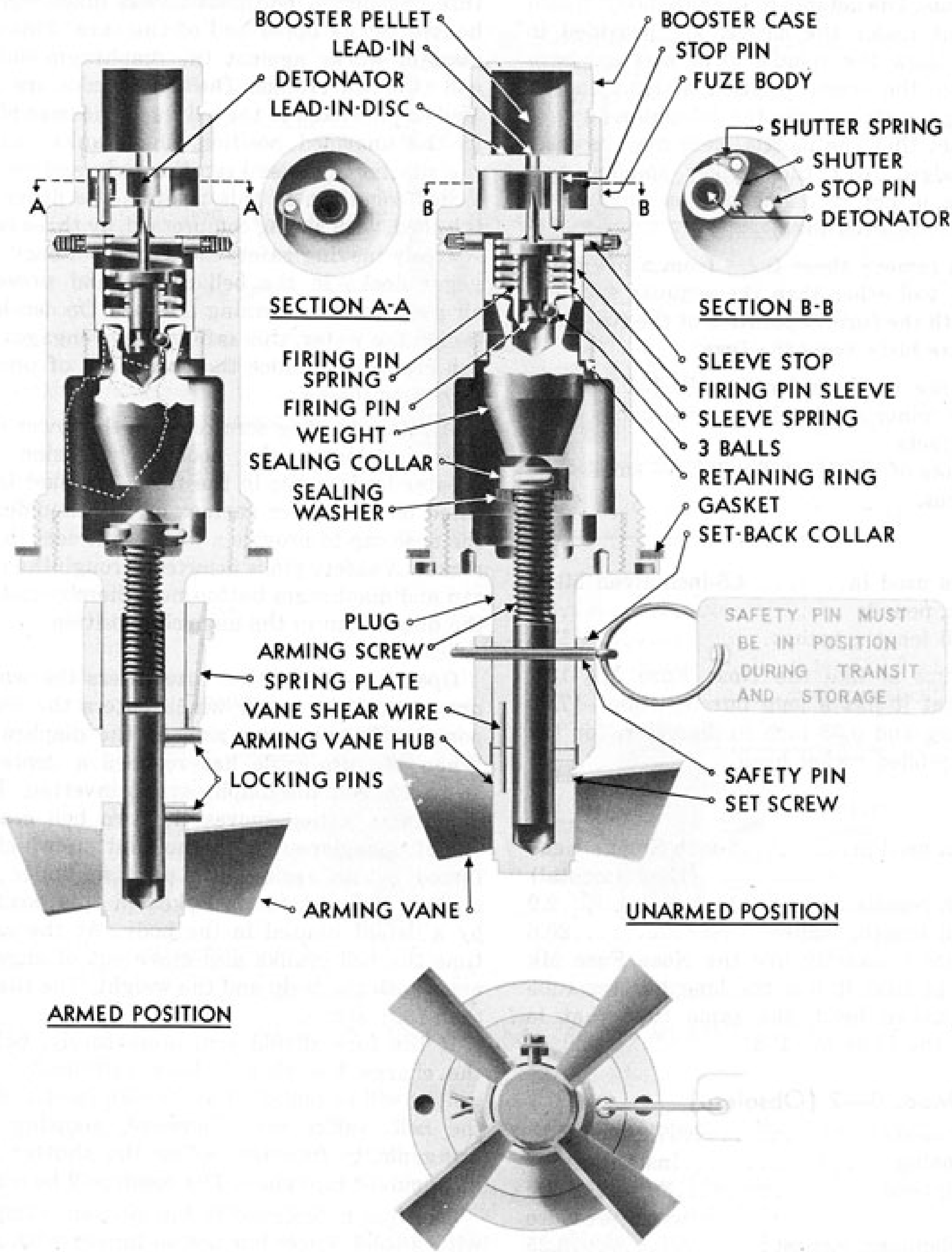


Figure 149. Navy Nose Fuze (Rocket) Mk 131 Type

Remarks: The detents in the fuze body, which spring out under the sleeve, are provided in order to allow the spindle to be screwed back down from the armed position without danger of forcing the striker into the detonator. In view of the fact that the inertia piece may be insecurely lodged over the striker spindle, this procedure is not recommended on any rocket that has once been fired.

Do not remove these fuzes from a projectile with any tool other than the spanner which is issued with the fuze. Separation of the two parts of the fuze body arms the fuze.

Difference in Mods for the Mk 131 and Mk 136 were minor distinctions, some being separate contracts.

Some lots of the Mk 136 will have small-vane shear wires.

Mk 132

Rockets used in........4.5-inch Head Mk 9
Weight, pounds 1.1
Over-all length, inches................19.5

This fuze is like the Nose Fuze Mk 137, except that it has a long burster tube—17.20 inches long and 0.38 inch in diameter, for the incendiary-filled rocket head.

Mk 133

Rockets used in.........5-inch Smoke Head (Experimental)
Weight, pounds 2.9
Over-all length, inches................20.6

The fuze is exactly like the Nose Fuze Mk 149, except that it has the long burster tube for the smoke head, the same tube that is found on the Fuze Mk 132.

Mk 135 Mods 0—2 (Obsolete)

Rocket used in................7.2-inch H.E.
Functioning ....Instantaneous
Arming time ....30 feet static water pressure
Body diameter, inches.................3.25
Over-all length, inches...................5

General: The fuze consists of a nose cap with two water ports which is screwed on the upper fuze housing. A phosphor-bronze diaphragm is housed in the upper end of the fuze. This diaphragm works against the diaphragm button and two bell cranks. The bell cranks are pivoted on pins fixed to the halves of the nose plate. In the unarmed position, the cranks engage the shutter and also keep the body and weight locked together. In this position the firing pin is locked, with spring compressed, by three balls. A freely moving safety sleeve, on set-back, engages hooks in the bell cranks and prevents air pressure from arming the fuze. On deceleration in the water, this safety sleeve engages the bell cranks to reduce the possibility of premature functioning.

A retaining ring screwed into the lower fuze housing secures the booster magazine and booster lead-in disc in the fuze. A gasket is located on the under surface of the shoulder of the nose cap to provide a watertight seat in the rocket. A safety pin is inserted through the nose cap and diaphragm button nut, thereby locking the diaphragm in the unarmed position.

Operation: When the fuze enters the water, pressure of the water which enters the water ports in the nose cap acts on the diaphragm. When the projectile has reached a depth of 15 to 20 feet, the diaphragm is inverted. This diaphragm action moves the two bell cranks out of engagement with the shutter, which is forced by its spring into position under the striker. The shutter is locked in this position by a detent housed in the body. At the same time the bell cranks also move out of engagement with the body and the weight. The fuze is then fully armed.

If the fuze should arm prematurely, before the charge has slowed down sufficiently, the weight will be pulled off by its own inertia when the bell cranks move outward, allowing the firing pin to function before the shutter will have moved into place. The result will be a dud.

The fuze is designed to function upon impact with a solid object but not on impact with soft objects such as muddy or sandy bottoms. Upon solid impact, the sudden deceleration pulls the weight forward, forcing the three balls inward. This frees the weight, allowing it to fall out of

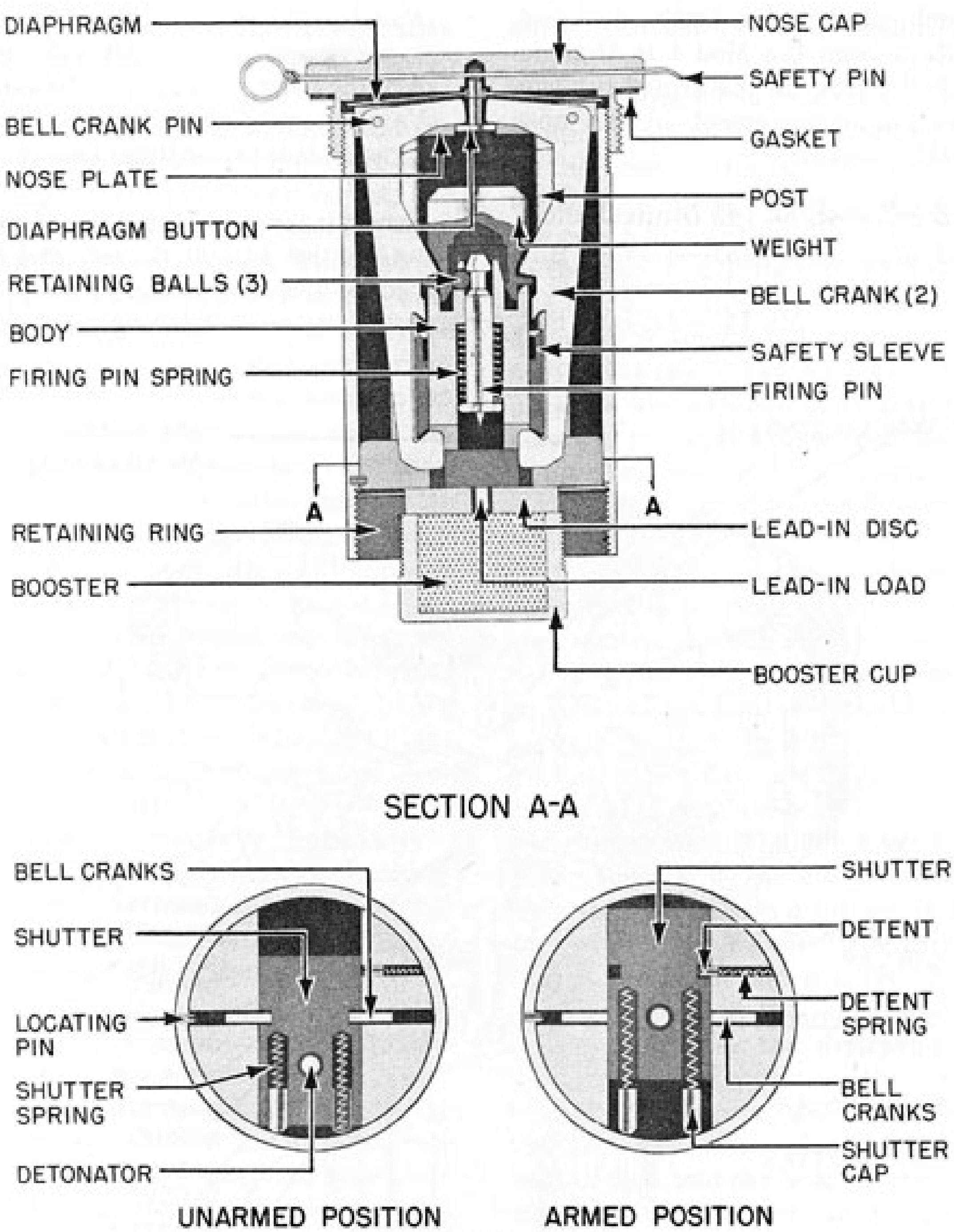


Figure 150. Navy Nose Fuze (Rocket) Mk 135 Type

its engagement with the body. The three balls are then ejected by the force of the firing pin working against its compressed firing-pin spring. The firing pin is now free to be forced by its spring against the detonator, thus actuating the fuze. A glancing blow causes the weight to pivot about a point on the edge, where it is supported against the body and releases the three balls. The sensitivity to forward and sidewise impact is about equal.

Remarks: The fuze will function under water on angles of impact up to 75°.

Mods 1 and 2 of this fuze are similar to the Mk 135 Mod 0 in general design, except that the sensitivity has been about doubled, and the static pressure to arm has been increased to a head of approximately 50 feet. The fuzes, when

fired from launchers, arm at a depth of 20 feet. The Mod 2 differs from the Mod 1 in that detents lock the bell cranks in the armed position and the safety pin arrangement in the nose has been slightly altered.

Mk 137 Mods 0—2 and Mk 145 Mods 0 and 1

Rockets used in ...... Mk 137—4.5-inch B.R. and 7.2-inch D.R.
Mk 145—4.5-inch B.R.

Functioning .... Mk 137—Instantaneous
Mk 145—0.02-sec. delay

Arming time .... 10 vane revolutions

Vane guard diameter, inches .... $2\frac{3}{4}$

Over-all length (without booster), inches . $2\frac{1}{2}$

General: These fuzes fire upon water impact for velocities of 300 ft./sec. and more, and at impact angles as small as 15° to 20°. They probably will not arm if the burning time is shorter

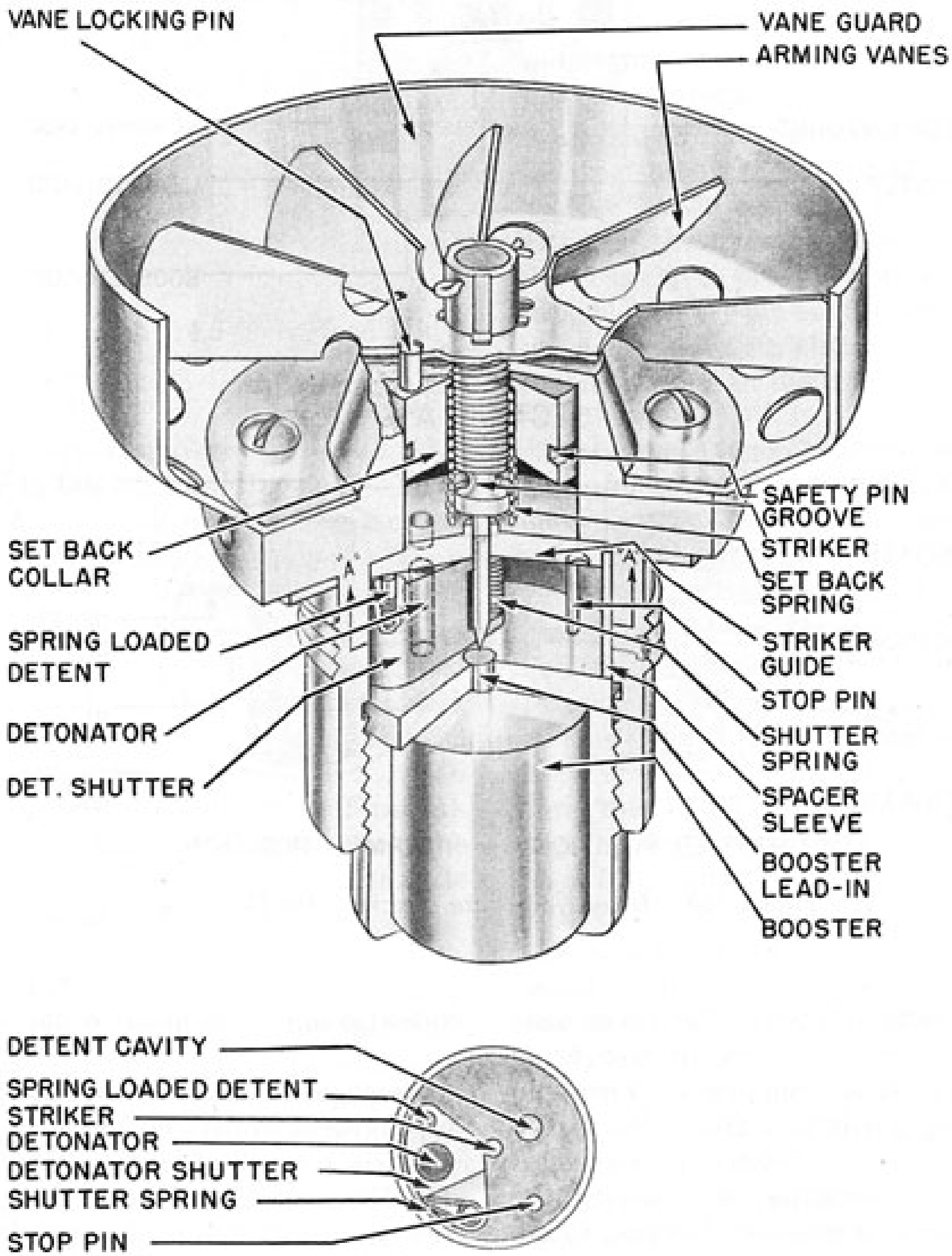


Figure 151. Navy Nose Fuze (Rocket) Mk 137 Type

than 0.2 second, or the velocity is less than 300 ft./sec.

Operation: When the rocket is loaded on the launcher, the safety pin securing the set-back collar is withdrawn. On firing the rocket, the set-back collar is forced back by inertia, compressing the set-back spring and withdrawing the vane locking pin from the hole in the vane boss. The vanes rotate freely, and after three to four rotations have unthreaded the striker spindle sufficiently that, when deceleration occurs, the vane locking pin cannot again engage the vane boss. After about ten vane rotations, the striker spindle is unthreaded sufficiently to free the detonator shutter, which is forced across the shutter cavity by its spring. It is stopped by the stop pin and is locked in the armed position by a spring-loaded detent housed in the shutter, which slips into a recess in the striker guide. When the striker has reached the end of its threads, it rotates freely with the vanes as the striker spindle collar rides in a groove in the underside of the fuze body. On impact, the threads on the fuze body are sheared as the striker is forced into the detonator.

The Mk 137 Mod 1 resembles the Mk 137, but has ten blades on the arming vanes as compared to eight, and also has a split spacer sleeve.

The Mk 137 Mod 2 is similar to the Mk 154 Mod 3. A modified vane lock-pin seat prevents premature arming.

The Mk 145 is similar to the Mk 137 but incorporates a 0.02-second delay in the detonator.

The Mk 145 Mod 1 has a modified vane lock-pin seat preventing premature arming.

Mk 139 (Obsolete)

Rockets used in	7.2-inch and H.E.
Functioning	Instantaneous
Arming time	About 3/4 sec. after launching
Body diameter, inches	2.5
Over-all length, inches	4.25

General: This fuze was designed for antisubmarine warfare and was used in rockets projected both from airplanes and from small patrol craft. The fuze functions on impact with a hard object, but not on water impact.

Description: The fuze body encloses the functioning mechanism. A waterproof cap is affixed to the nose of the fuze and is held in position by two bands locked by a safety pin. Beneath the cap, a firing wheel is attached by a setscrew to the end of a firing pin. This wheel is formed like a cross to present less surface and prevent firing on water impact. The slide stop pin, riveted to the cap, engages a leg of the firing wheel. This pin also extends down into the nose plate, where it prevents a slide from moving outward. A flywheel and set-back collar, separated by a spring and secured by the flywheel screw, form a subassembly. This assembly is placed on the shaft of the firing pin. A pin set in the slide engages the set-back collar in order to prevent its rotation. A clock spring, secured on one end to the flywheel and on the other end to a pin on the closure disc, is assembled under tension so as to impart its force to the flywheel. The pin to which the clock spring is attached is anchored to the fuze body to prevent rotation of the closure disc. The firing pin is screwed into shear threads in the closure disc. A detonator shutter is affixed on a pin set in the lower surface of the closure disc. The firing pin extends into a cavity in the shutter. A tightly fitted spacer ring set in the body maintains a spring detent housed in the detonator shutter. This ring, interposed between the closure disc and lead-in disc, provides free movement of the shutter. The lead-in charge is contained in the lead-in disc, and the booster charge in a booster magazine which screws into the fuze body.

Operation: When the arming wire is withdrawn as the rocket is launched, the clamps are unlocked and forced off by the clamp spring. The waterproof cap flies off by the action of its compressed springs. Set-back causes the set-back collar to move back against its spring. This movement releases the slide pin in the nose cap, permitting the flywheel assembly to be rotated by the force of the clock spring. This rotation is transmitted to the firing pin, causing it to screw outward, thereby withdrawing the firing pin from engagement with the detonator

shutter, which is forced by its spring into alignment with the firing pin. Once the shutter moves into the armed position, it is locked by a spring-loaded detent.

On impact of the firing wheel with a solid object, the firing pin is driven backward and shears the shear threads of the closure disc. It then pierces the detonator, setting off the explosive train.

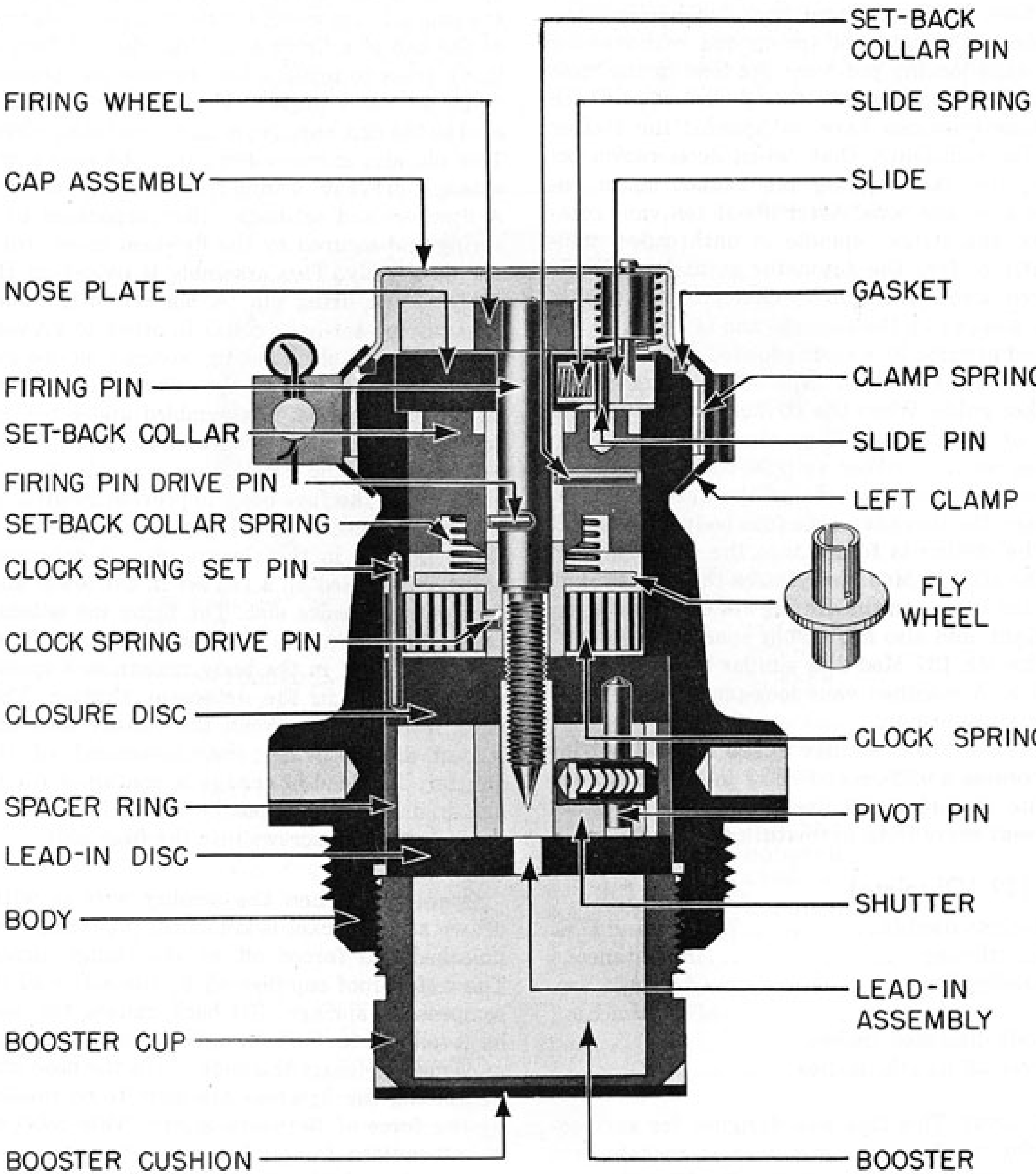


Figure 152. Navy Nose Fuze (Rocket) Mk 139

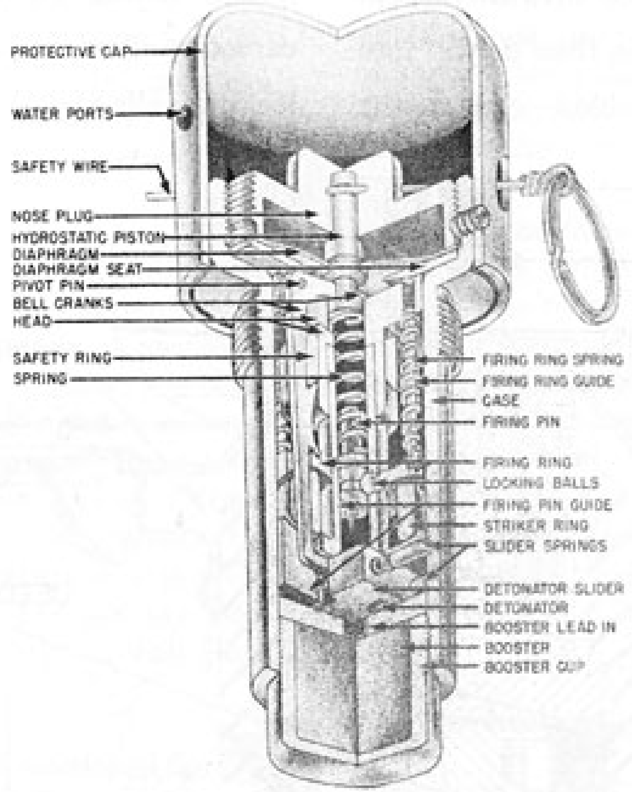


Figure 153. *Navy Nose Fuze (Rocket) Mk 140*

Mk 140 (Recalled)

Rockets used in..........7.2-inch Mousetrap and Hedgehog
Functioning ....Instantaneous
Arming time ....Static pressure of approximately 30 feet of water
Body diameter, inches..................2.7
Over-all length, inches.................4.5

General: This fuze was developed and issued to replace the Nose Fuzes Mks 131 and 136 in the 7.2-inch Mousetrap and Hedgehog. It arms by hydrostatic pressure and has safety features which prevent it from firing either on set-back or on impact with the water. Its sidewise sensitivity is 1/6 to 1/4 of the nose sensitivity, and a glancing blow permits the fuze to function. Orders have been issued that this fuze is not to be used, and it will be recalled. The fuze can be used by blimps in 7.2-inch heads with the inert motor, when dropped as bombs.

Operation: When the rocket is fired, the arming wire is pulled. On set-back, the safety ring is forced down over the upper hooks on the two bell cranks, preventing them from spreading out and releasing the detonator slider. On impact with the water, the firing ring slips down a slight amount and engages the lower hooks on the bell cranks, thus preventing the bell cranks from spreading to release the detonator slider on water impact; the hooks on the crank also prevent the firing ring from dropping free of the locking balls. As the rocket travels through the water, water enters the ports in the protective cap and through the holes in the nose plug which formerly received the arming wire. After reaching a depth of from 8 to 15 feet, the pressure of the water will invert the phosphor-bronze diaphragm, which presses down on the inner ends of the bell cranks. Since the bell cranks are pivoted about pivot pins, they swing clear of the detonator slider, which is forced over to the armed position by two springs, and locked there by a spring-loader detent. On impact with a hard surface, the firing ring is forced by inertia against its two firing-ring springs, which are coiled around two guide pins. This action of the firing ring frees the

locking balls, which are forced outward by the spring-loaded striker, which is then driven into the detonator. A glancing blow causes the loosely fitting striker ring to move sidewise, camming the firing ring forward, releasing the locking balls and firing the fuze.

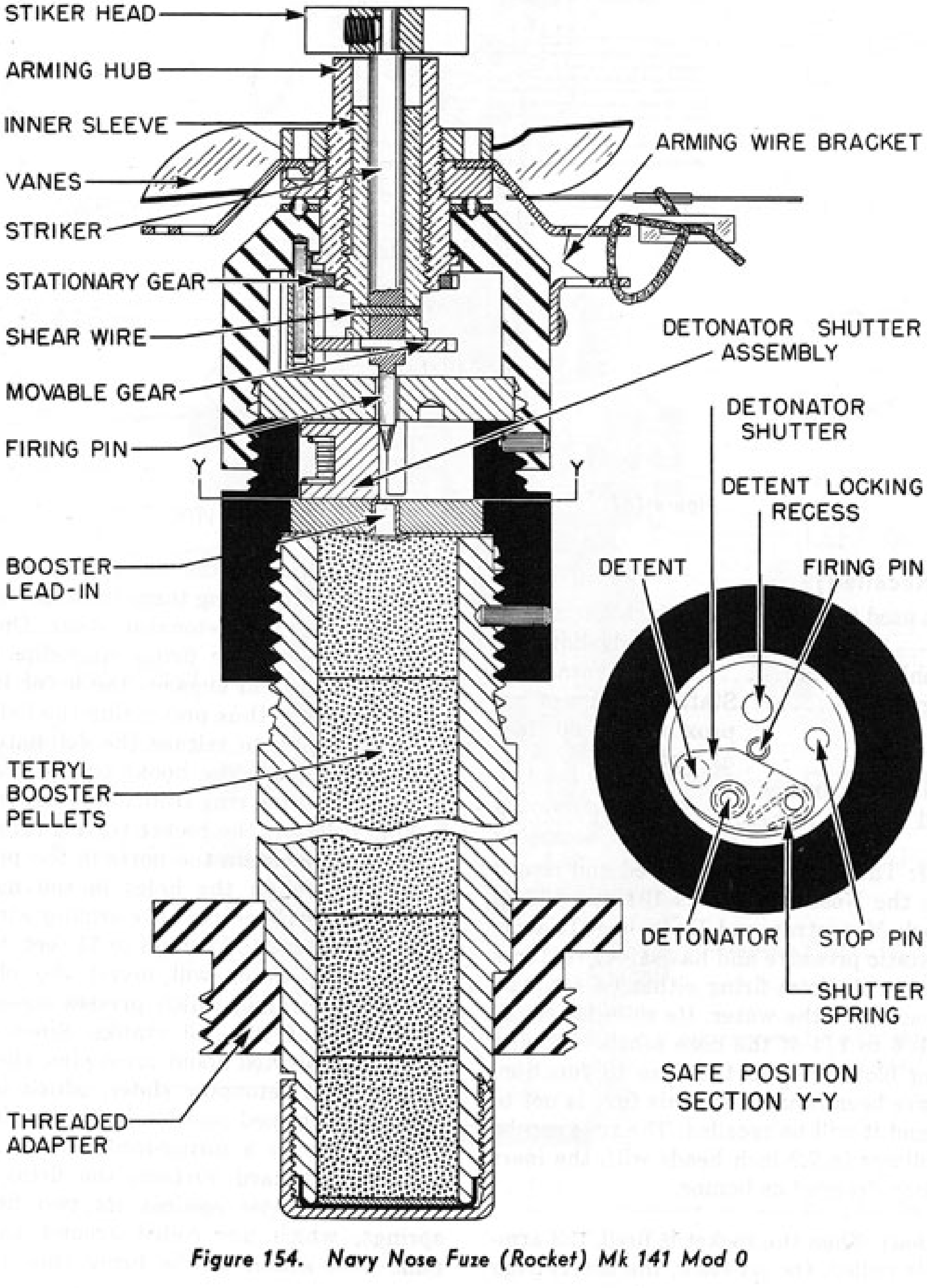


Figure 154. Navy Nose Fuze (Rocket) Mk 141 Mod 0

Mk 141 Mod 0

Rockets used in	7.2-inch D.R.
Functioning	Instantaneous
Arming time	90—130 vane revolutions
Body diameter, inches	1.75
Over-all length, inches	8.5

General: The Nose Fuze Mk 141 Mod 0 is issued to amphibious groups for use in destroying beach obstacles. The fuze is water-discriminating and so designed that it will not fire on impact with water but will be actuated by impact with the earth or soft sand, provided the water travel before impact is not more than twenty feet. The water-discriminating feature is obtained by use of a copper shear wire. The Mk 141 Mod 0 will replace the Mk 152 in the 7.2-inch Demolition Rocket, Head Mk 5.

Description: The fuze was developed from the Bomb Nose Fuze AN–M110A1 and retains the upper body and gear-reduction system used in that fuze. To obtain detonator safety, a pivoted detonator shutter has been added below the firing pin. The shutter is held in the safe position by the firing pin, and, when the fuze is armed, the shutter is locked in position by a spring-loaded detent. The safety block of the bomb fuze has been replaced by the arming hub, an integral extension of the stationary gear which locates the cross-shaped striker head in the safe position. The movable gear in the Mk 141 Mod 0 acts to thread the striker assembly forward and out of the fuze body, thus withdrawing the firing pin from the detonator shutter slideway, releasing the shutter to move into the armed position, and moving the striker head away from the arming hub. The striker and firing pin are mounted, by a copper shear wire, in the inner sleeve which forms the threaded hub of the movable gear. The arming wire bracket of the bomb fuze has been retained and, in shipment, a safety wire ties the vanes to this bracket. To insure proper air flow past the fuze vanes, an elongated booster chamber has been added to the fuze. This cavity, loaded with tetryl increments, extends the tip of the fuze six inches beyond the rocket head. At the lower end of the booster chamber a threaded adapter has been fixed to adapt the 1½-inch diameter fuze to the 2-inch diameter fuze pocket. Two Auxiliary Boosters Mk 1 Mod 0 are required in the fuze pocket.

Operation: When the rocket is fired, the arming wire is pulled, and the vanes are free to rotate. The rotation of the vanes acts through the reduction gears to thread the inner sleeve up in the arming hub and thereby withdraw the firing pin from the detonator shutter. The shutter is forced across the shutter cavity by its spring and is locked in the armed position by the spring-loaded detent. On impact, the striker is driven down, shearing the copper shear wire, and fires the detonator, booster lead-in, and booster.

Mk 147 Mod 1 and Mk 148

	Mk 148
Rockets used in	3.5-inch Heads Mks 3, 5, and 9 5.0-inch Head Mk 1
Functioning	Instantaneous
Arming time	8 vane revolutions
Vane span, inches	1½
Body diameter, inches	1¾
Over-all length (without booster), inches	2¼

General: The Nose Fuze Mk 148 is similar to the Mk 137, but has smaller vanes, and, instead of a vane guard, is shipped with a protective cap which is removed when the rocket is loaded on the plane. It fires at impact angles as low as 5° and 10° for water or land targets, allowing slight penetration. On hard targets, it fires at impact angles not less than 20° to 25°.

Operation: The weather cap is removed when the rocket is loaded on the launcher. After the rocket is loaded on the launcher, the safety wire is withdrawn and the arming wire is installed through the arming-wire guide. Two Fahnestock clips secure the arming wire. When the propellant is ignited, the forward motion of the rocket pulls the arming wire free and the force of inertia causes the set-back block to set back against the set-back spring. Since the vane lock-

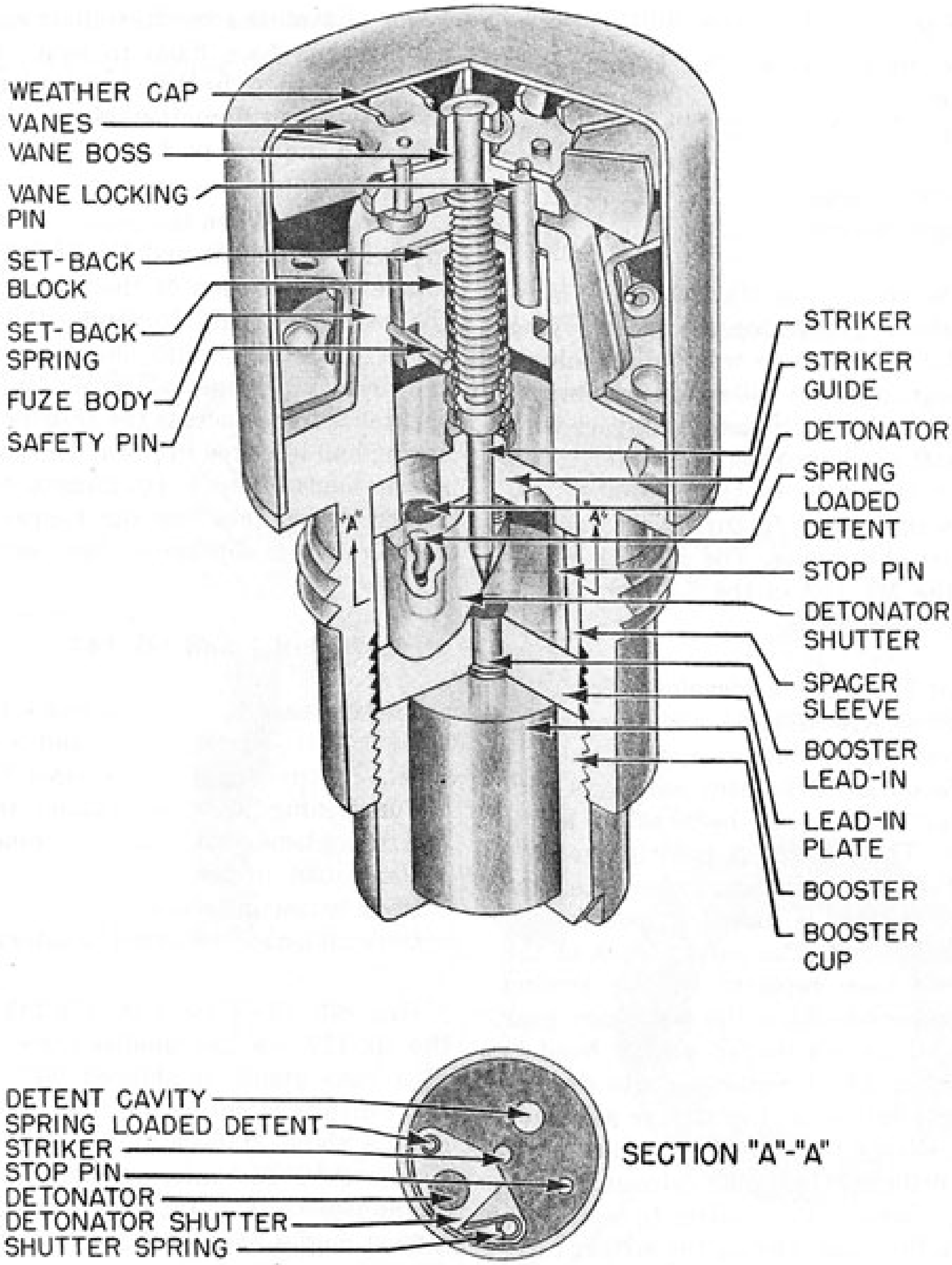


Figure 155. Navy Nose Fuze (Rocket) Mk 148

ing pin is positively attached to the set-back block, it is thus withdrawn to a position flush with or below the top of the fuze body. This frees the vanes to rotate, unscrewing the striker as they rotate. The vanes must make from three to four rotations during acceleration to unscrew the striker sufficiently to prevent re-engagement of the vane locking pin as the set-back spring gradually forces the set-back block and locking pin up. After eight or nine rotations of the vanes, the striker will have unthreaded sufficiently to free the spring-loaded detonator shutter. The latter is then rotated by the shutter spring into the armed position, where it is stopped by the stop pin, lining the detonator up with the striker and booster lead-in. As

the shutter reaches the armed position, a spring-loaded detent carried in the shutter is forced into a recess in the striker guide, locking the shutter in the armed position. After an additional rotation or two, the end of the threads on the striker spindle is reached, and the vanes rotate freely as the collar at the end of the threads rides in a groove in the fuze body. On impact, the striker is forced in, shearing the threads in the nose of the fuze body, and is driven into the lead azide detonator.

Mk 147 Mod 0: This fuze is used in the 7.2-inch chemical warfare rocket and is similar to the Mk 148, except that it has no arming wire guide like the Mk 148, and no booster. Instead of the booster, there is an adapter which receives a burster tube to break open the rocket and eject the chemical filler. The fuze has a vane guard which consists of a cylindrical tube open at the top, with perforations around the tube just above the top of the fuze body.

Mk 147 Mod 1: This fuze is identical to the Mod 0, with the exception of the vane guard, which has been replaced on the Mod 1 by a protective cap.

Mk 149 and Mk 155

	Mk 149
Rockets used in	3.5-inch A.R., Heads Mks 3, 5, and 9 5.0-inch A.R., Heads Mks 1, 5, 6, and 6 Mod 1
Functioning	Instantaneous
Fuzes used with	Alone, or with Mk 146, 157, 159, 159 Mod 1, 164, or 165
Arming time	8 vane revolutions
Vane span, inches	1⅛
Body diameter, inches	3
Over-all length (without booster), inches	3½

General: The working parts of the fuze are very similar to those of the Nose Fuze Mk 148, which it is replacing. The essential changes are the addition of a second set-back block, a shutter locking pin, a nose cap and clamp, and smaller but less sharply pitched vanes. The fuze body itself is more streamlined. The addition of the spring-loaded weather cap over the vanes protects the vanes from icing up during flight of the aircraft at high altitudes. This cap does not spring off until the arming wire is pulled from the clamp when the rocket is fired.

Operation: When the rocket is fired, the arming wire is pulled free from the clamp pin and the compressed weather-cap spring forces the weather cap up, spreading the clamp until the weather cap is free. The force of inertia causes the two set-back blocks to fall back against the pressure of the set-back spring. This accomplishes two things: First, the vane locking pin is freed from the vane boss and the vanes are free to rotate and screw the striker upward. Second, the lower set-back block forces the shutter locking pin down into the shutter cavity, preventing the shutter from moving over and lining up under the striker as long as the rocket is accelerating (i.e. as long as the rocket motor is burning). After eight vane revolutions, the point of the striker will have risen clear of the shutter; and, upon reaching the end of the threads, the spindle stops as the striker collar rides in the groove in the fuze body. After the rocket propellant has ceased burning, deceleration occurs and both set-back blocks are forced up by the set-back spring. The shutter locking pin is thus lifted from the shutter cavity and the shutter moves across the fuze under influence of its spring until stopped by the stop pin. A spring-loaded detent in the detonator shutter springs up into a recess in the striker guide, locking the shutter in the armed position. On impact, the striker shears the body threads and is driven into the detonator, setting off the booster lead-in and booster in succession.

Mk 155: The Nose Fuze Mk 155 is used in the F.S. or P.W.P. smoke-filled 3.5-inch Heads Mk 6. The fuze is similar to the Nose Fuze Mk 149, with a burster tube instead of a booster charge.

Mk 152

Rockets used in	7.2-inch D.R. (Head Mk 5)
Functioning	Instantaneous

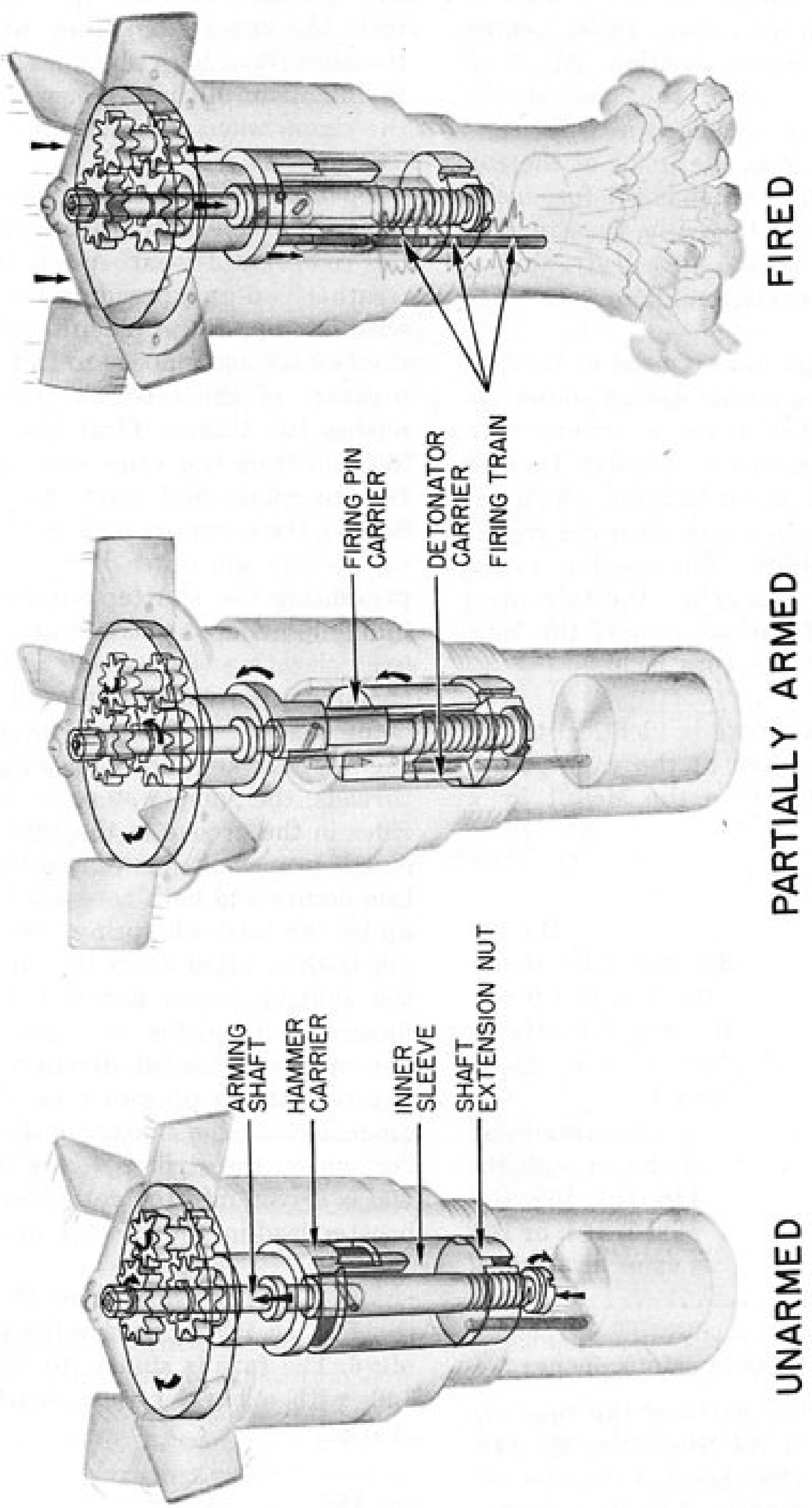


Figure 156. Navy Nose Fuze (Rocket) Mk 152

Arming time..........120 vane revolutions
Vane span, inches......................4.75
Body diameter, inches..................2.75
Over-all length, inches.................5.5

General: This fuze is identical to the Bomb Fuze AN–Mk 219, except that it has been partially armed fifty turns of the arming vanes and a metal fork has been inserted between the vane carrier and the fuze body to take up the space left by the pre-arming process. This fork must be removed before launching the fuzed rocket. In addition, the pitch of the vanes has been increased to 40 degrees instead of the 18 degrees on the AN–Mk 219.

The Bomb Fuze AN–Mk 219 must not be used in place of the Rocket Fuze Mk 152, and vice versa.

When installing the Fuze Mk 152 in a demolition rocket, be sure to use a regular adapter ring for the Bomb Fuze AN–Mk 219, the same as when installing the Bomb Fuze AN–Mk 219 in the nose of a depth bomb. The fuze cavity in the rocket body is deep enough to necessitate the addition of the following with the Fuze Mk 152: Auxiliary Booster Mk 2 (two inches long); Auxiliary Booster Mk 1 (three inches long); and one cardboard spacer approximately ½ inch thick placed below the auxiliary boosters. Tests have indicated that a high-order detonation can still be expected if an additional cardboard spacer is used in place of the Auxiliary Booster Mk 2; however, use of the booster is preferred.

When the rocket is placed in the launcher, an arming wire, one end of which is attached to the launcher, replaces the safety pin. This assembly prevents fuzes of other rockets in the launcher from arming as a result of the blast from rockets already launched. Both safety pin and arming fork must be replaced if the rocket is not fired.

Operation: There are two stages of arming. During the first stage, the upper gear is free to rotate and the lower gear, being attached to the hammer carrier locked by the inner sleeve, is held stationary. During the second stage, the hammer carrier has risen to clear the inner sleeve, and the lower gear is free to rotate, while the upper gear is held stationary, as it is attached to the arming shaft, which was threaded up until it locked against the shaft extension nut.

First stage: As the rocket is launched, the arming wire is withdrawn and the vanes are free to rotate. Through the system of reduction gears, the upper gear rotates to thread the arming shaft up until the head of the screw on the shaft locks against the shaft extension nut. A collar on the shaft lifts the hammer carrier and the entire arming assembly. Simultaneously with the locking of the arming shaft and the upper gear, the hammer carrier clears the inner sleeve to free the lower gear.

Second stage: The lower gear and hammer carrier are rotated in a counterclockwise direction. The aligning lug on the hammer carrier engages the firing-pin carrier, lining up the firing-pin extension with the firing pin. Further rotation causes the firing-pin carrier to engage the detonator carrier, lining the firing pin up with the detonator. The hammer carrier, firing-pin carrier, and detonator carrier continue to rotate through 180 degrees, until the lip on the detonator carrier engages the inner sleeve. Simultaneously, the spring-loaded detent in the striker snaps into a recess in the hammer carrier, thus locking the firing train components in an armed position. Since the upper and lower gears are now both locked, the two copper pins securing the lower gear to the hammer carrier are sheared and the vanes rotate freely. If the air speed is less than 300 m.p.h., the air pressure will not be sufficient to shear the pins, and the vanes will merely cease rotating.

The fuze is now fully armed. On impact, the entire upper assembly of the fuze is forced inward. The shear wire in the arming shaft is cut as the upper part of the shaft telescopes into the lower part, and the shear wire through the firing pin is cut as the firing-pin extension forces the firing pin into the detonator. The detonator sets off the auxiliary booster lead-in, booster lead-in, booster, and main charge successively.

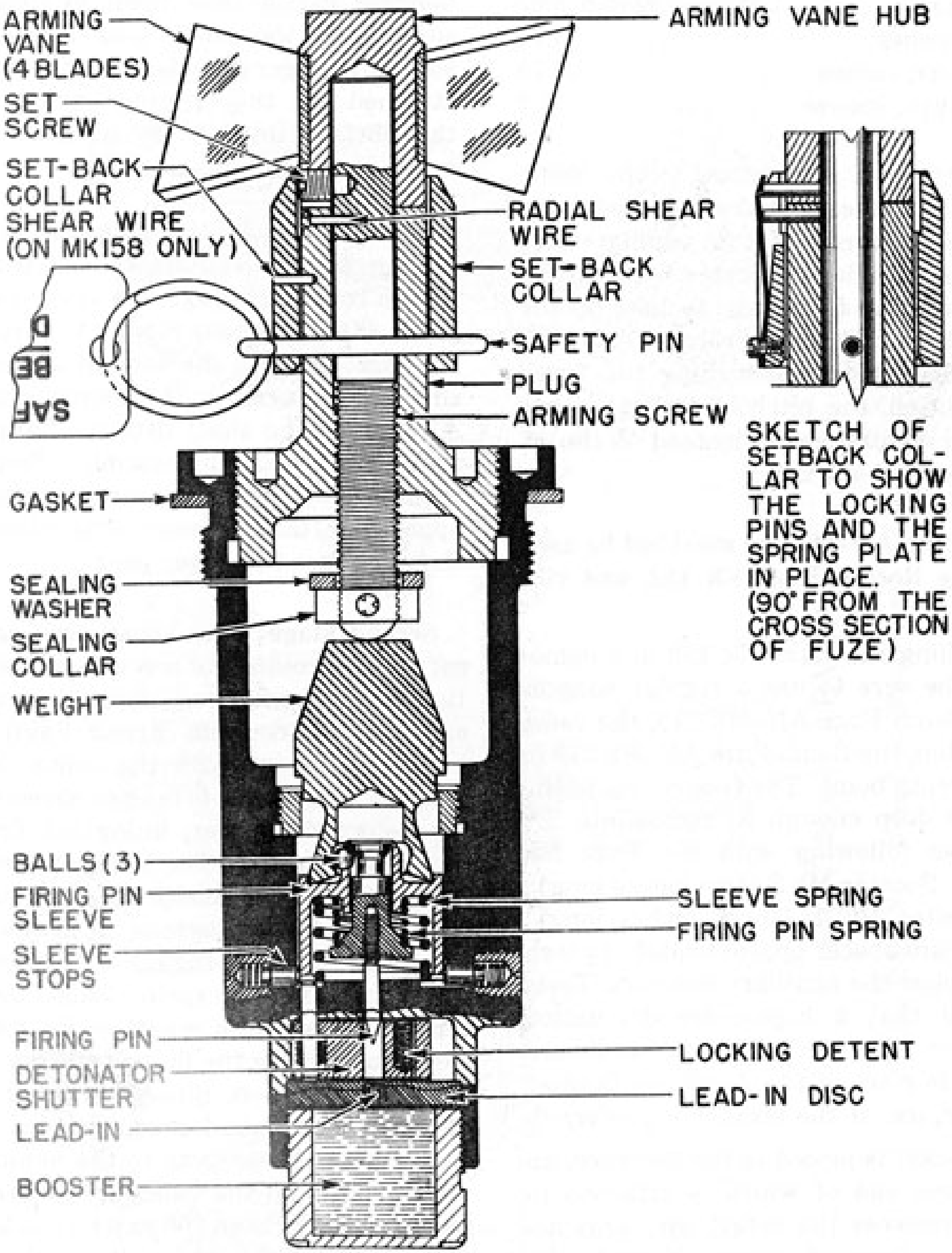


Figure 157. Navy Nose Fuzes (Rocket) Mk 156 and Mk 158

Mk 156 and Mk 158

Rockets used in	Mk 156—7.2-inch H.E. Mk 158—7.2-inch Projector charge
Functioning	The Mk 156 has red point on nose of vane hub
Arming time	4 to 5 vane revolutions
Vane span, inches	3.125
Maximum body diameter, inches	2.25
Over-all length (without booster), inches	6.9

General: The two fuzes are identical, except that the Nose Fuze Mk 158 Mod 0 has a shear wire in the set-back collar. These fuzes were

designed to replace the Nose Fuzes Mk 131 and Mk 136 respectively.

Operation: The safety pin is removed when the rocket is loaded on the launcher, leaving the vanes secured by the set-back collar, which has a leaf spring holding it up by pressure against the locking pins. On firing, the set-back collar moves back (breaking the shear wire in the Nose Fuze Mk 158), freeing the locking pins from the groove in the collar. On impact with water, the force on the vanes causes a torque sufficient to shear the radial shear wire holding the vane cup to the neck of the fuze. The vanes are free to rotate, unthreading the spindle through the neck of the fuze body. As the spindle draws back from the inertia weight, the spring under the firing sleeve forces the sleeve and inertia weight up. Since the firing pin is locked to the firing sleeve by three locking balls, the firing pin and its spring, cocked against a collar on the firing pin, rise with the sleeve and inertia weight. As the sleeve clears the four spring-loaded sleeve stops in the fuze body just above the firing pin guide, they spring out under the sleeve. After approximately four vane rotations, the firing pin will have been raised by the sleeve sufficiently to clear the shutter cavity, allowing the spring-loaded detonator shutter to move over into the armed position with the detonator lined up with the firing pin and booster lead-in. The detonator shutter is locked in position by a spring-loaded detent. The spindle continues to rise until the washer to which it is keyed engages a groove in the underside of the fuze neck. The inertia weight, sleeve, and firing pin cease rising when the sleeve engages the retaining ring. On contact with a submarine or other underwater obstruction, inertia causes the weight to move forward on normal impact or laterally on oblique impact, thereby allowing the three locking balls to jump out and release the spring-loaded firing pin.

Remarks: The sleeve stops in the fuze body which spring out under the sleeve are provided in order to allow the spindle to be screwed back down from the armed position without danger of forcing the striker into the detonator. In view of the fact that the inertia piece may be insecurely lodged over the striker spindle, this procedure is not recommended on any rocket that has once been fired.

Do not remove these fuzes from a projectile with any tool other than the spanner which is issued with the fuze. Separation of the two parts of the fuze body arms the fuze.

Mk 154 Mod 3

Rockets used in........4.5-inch B.R. Smoke
Functioning ....Instantaneous
Arming time ....100 vane revolutions
Vane guard diameter, inches............2¾
Over-all length, inches...............16.56

General: This fuze consists of a Nose Fuze Mk 137 Mod 2 fuze plus a tetryl burster tube 14.06 inches long. A steel collar is brazed to the upper end of the tube. A rubber gasket is inserted between the burster-tube collar and the burster retaining disc. Between the wall of the burster tube and the inside wall of the burster retaining disc is left a clearance of approximately 0.03-inch. This clearance, in addition to the rubber gasket, allows the burster tube a certain degree of flexibility, which is desirable when installing the complete fuze assembly in the fuze adapter of the rocket body.

Remarks: No disassembly of this fuze is authorized.

V.T. Mk 170 Mods 0 and 1, V.T. Mk 173 Mods 1—5, and V.T. M402

Rockets used in..Mk 173—Head Mk 10 (S.S.)
Mk 170—4.5-inch Mk 16 (S.S.)
Functioning........20- to 60-ft. aerial burst when fired 15° to horizontal
Over-all length, inches..................8.5
Materials.............Nose section—plastic
Base ring—steel
Body—steel

Description: The V.T. Fuzes Mk 170 and Mk 173 Series are for spinner rockets. The Army

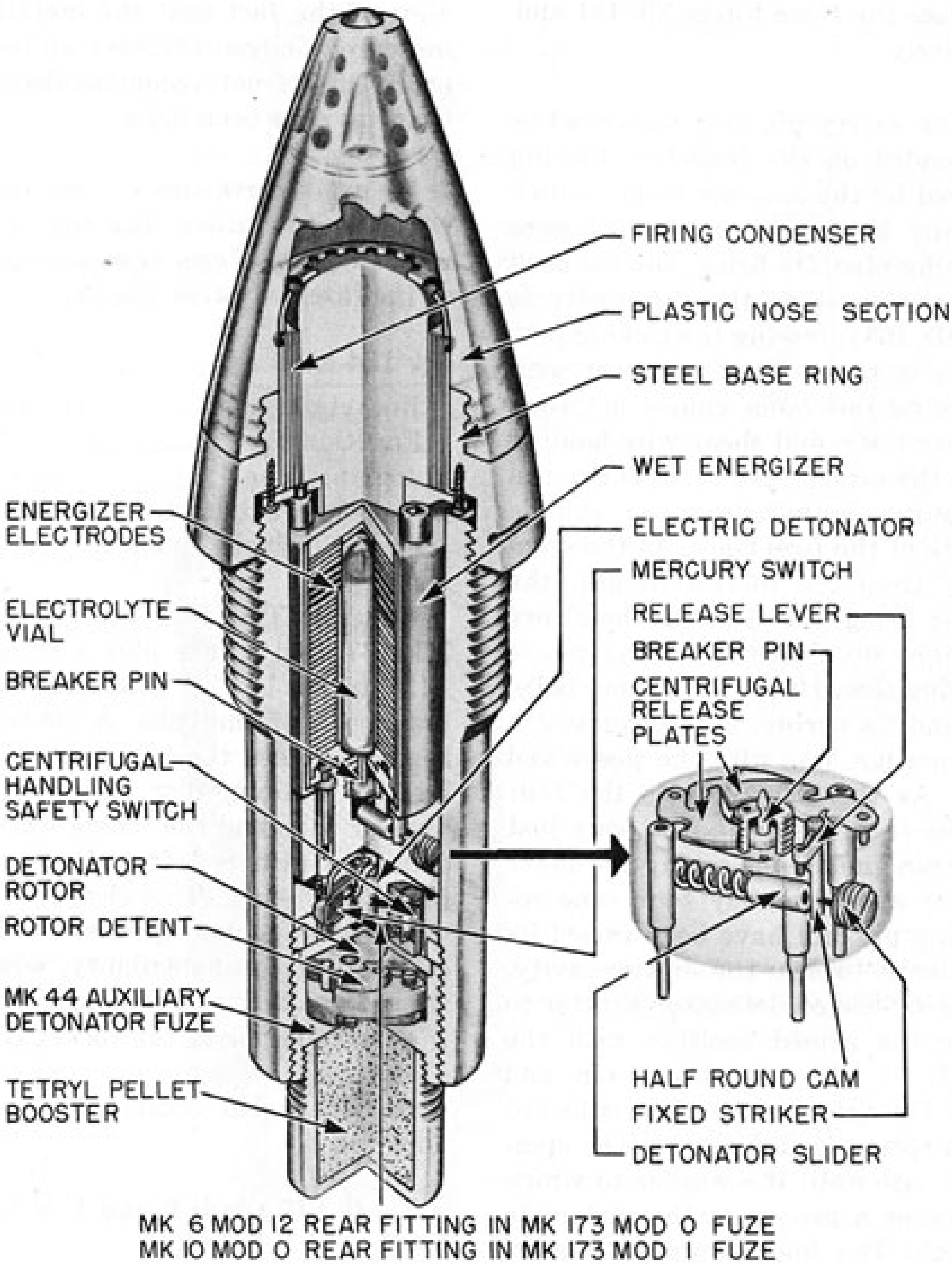


Figure 158. V.T. Fuzes Mk 170, Mk 173, and M402

designates the Mk 170 Mod 1 as the M402.

Bursting heights will depend on the angle of approach to the target and the type of target, as in all V.T. fuze operation. When the rockets are fired at a 15-degree angle from the horizontal, bursting heights over average land targets will be 20 to 60 feet, while bursting heights will be 40 to 80 feet when the rockets are fired at a 45-degree angle of elevation.

Minimum range for the V.T. Fuze Mk 173 in the Navy 5.0-inch S.S. rocket is 2,500 yards, at which point only 26% of the fuzes will operate properly upon approach to the target. Best results are obtained at ranges between 3,000 yards minimum and 5,000 yards maximum—maximum effective range of the rocket. In these limits, 75 to 80% of the fuzes should function properly upon approach to the target.

It has been found necessary to use a very long arming delay on these V.T. fuzes to give

assurance that the fuze will not be armed until the after-burning of the rocket motor is no longer a hazard. If the fuze were armed earlier, after-burning would cause the V.T. fuze to function prematurely, thereby wasting the round.

Minimum range of the V.T. Fuze Mk 170 or M402 in the 4.0-inch Army rocket is 2,500 yards, at which point 50 per cent of the fuzes will function properly upon approach to the target. Effective range limits are 3,000 yards to 5,000 yards, for full operability. Bursting heights are about the same as for the V.T. Fuze Mk 173 in the Navy rocket.

Operation: After the rocket is fired, when spin has reached 25 to 30 revolutions per second, the centrifugal release plates in the spin breaker swing outboard simultaneously against their hair springs, thereby freeing the release lever. This lever swings outboard, freeing the half-round cam which is rotated counterclockwise by the spring-loaded detonator slider, releasing it. The detonator slider is snapped against the fixed striker, firing the detonator. The force of the explosion is exerted against the head of the breaker pin, forcing it upward through a hole in the bottom of the wet energizer and into the electrolyte vial, breaking it. Centrifugal force distributes the electrolyte, energizing the powder supply. Electrical energy is supplied to the V.T. element.

In the meantime, the rocket has attained its terminal spin velocity of about 140 revolutions per second, and the mercury in the mercury switch in the rear fitting is forced outboard through the porous membrane. After a delay of two to eight seconds, depending upon the rate of spin and the temperature, the short circuit across the squib caused by the mercury is relieved and the squib is armed.

When spinning of the rocket starts, the rotor detents of the auxiliary detonating fuze swing outboard, but the rotors are prevented from lining up by their friction against the bottom of the housing, caused by acceleration. When burning is over, the unbalanced rotors swing into position, arming the auxiliary detonating fuze.

When spinning of the rocket starts, the reed contact in the centrifugal handling safety switch is forced outboard, allowing the firing condenser to start accumulating a charge through a high-resistance circuit as soon as the wet energizer is activated. In about five seconds after the beginning of charging, sufficient charge has been accumulated to allow firing of the electric detonator and the fuze is armed.

Upon approach to the earth, the V.T. element completes the firing circuit and discharges the firing condenser through the electric detonator. The force of the explosion detonates the auxiliary detonating fuze, which initiates detonation of the main charge.

In the V.T. Fuze Mk 173 Mod 1 or the V.T. Fuze Mk 170 Mod 1, if the V.T. element does not function upon approach to the target, the Rear Fitting Mk 10 Mod 0 will cause instantaneous operation upon impact.

Remarks: A rear fitting containing the safety and arming features common to V.T. fuzed rounds will be the Rear Fitting Mk 6 Mod 12 in the V.T. Fuze Mk 173 Mod 0 or Mk 170 Mod 0. It contains a mercury switch across the squib, which unshorts as a result of spin, and a centrifugal handling safety switch which allows a charge to be accumulated on the firing condenser only while the round is spinning.

The Rear Fitting Mk 10 Mod 0 is used in the V.T. Fuzes Mk 173 Mod 1 and Mk 170 Mod 1 and, in addition to the components of the standard Rear Fitting Mk 6 Mod 12 described above, also contains a mechanical impact firing feature consisting of a fixed striker and a movable detonator with approp, detents and anti-creep springs to give adequate safety.

V.T. Fuzes Mk 173 Mods 2, 3, 4, and 5 are waterproofed fuzes. Mk 173 Mods 0, 1, 2, and 3 are not under procurement by the Bureau of Ordnance. Mods 0 and 1 had no auxiliary detonating fuze waterproofing; Mods 2 and 4 are like the Mod 0 in that the Rear Fitting Mk 6 Mod 0 is used. Mods 1, 3, and 5 have the impact detonator. The Mod 5 is the one being manufactured in quantity to supply the fleet.

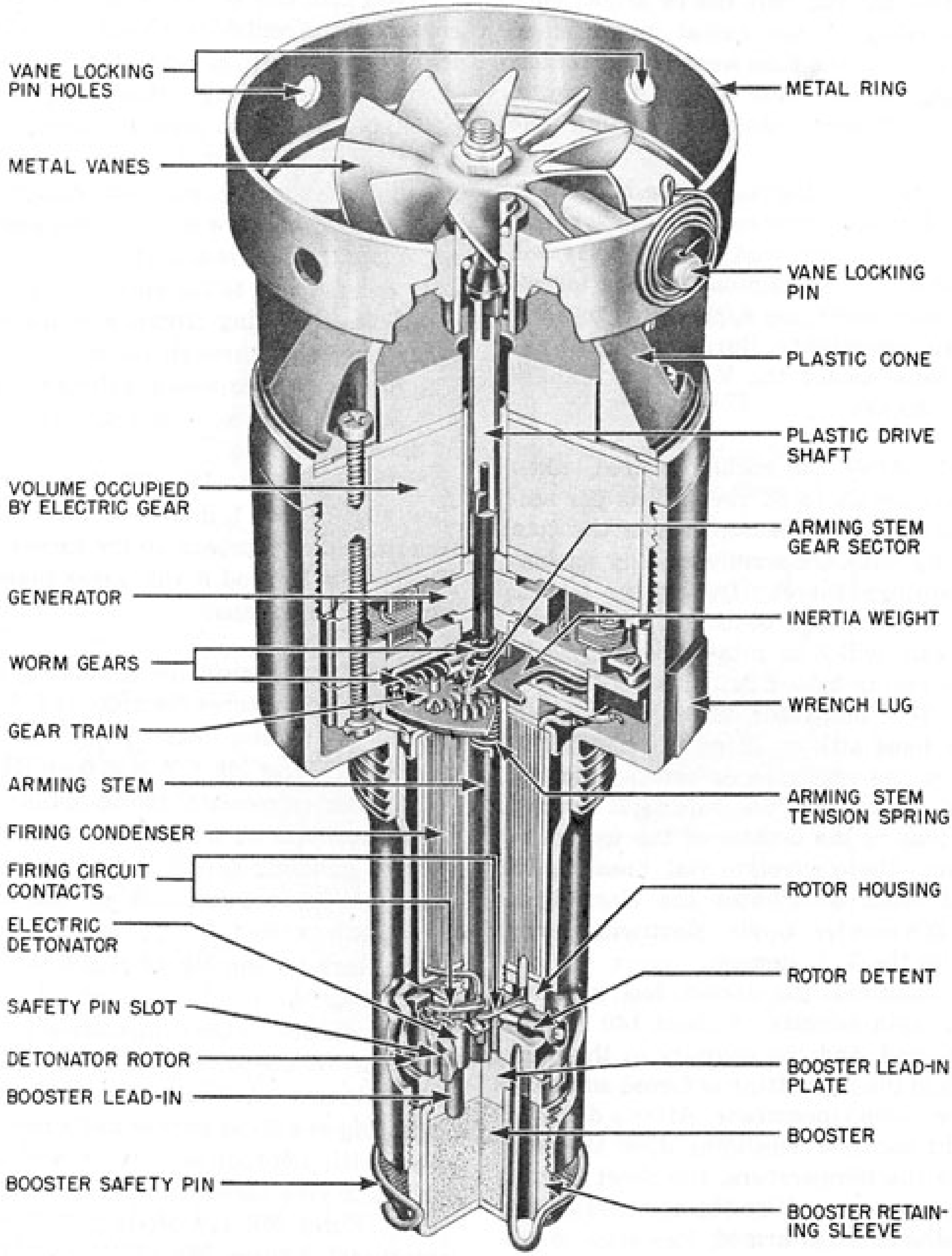


Figure 159. V.T. Fuzes Mk 171, Mk 172, and T2004

V.T. Mk 171, Mk 172, and T2004

Rockets used in	5.0-inch A.R. Mk 1 Mod 1 Head
Functioning	By impulse on approach to target
Fuzes used with	Mk 157 Mod 0 or Mk 165 Mod 0
Arming distance	340 yd. at 0° F. 255 yd. at 110° F.
Launched at 300 knots	1030 yd. at 0° F. 810 yd. at 110° F.
Body diameter, inches	3.4
Over-all length, inches	10.4

General: The Mk 172 is a V.T. fuze for Navy-type-fin stabilized rockets. The complete round is designated as Rocket Assembly Mk 1 Mod 5.

Description: In appearance, the V.T. Fuze Mk 172 is the same as the V.T. Ring-Type Bomb Fuze T50. The fuze may also be marked as the T2004 for use in Army rockets. Internally, the fuzes are also similar, except that a set-back has been added in the V.T. Fuze Mk 172 Mod 0.

Operation: When the rocket is launched, the arming wire is withdrawn from the vane locking pin, which in turn is forced out by its spring to free the vanes. At the same time, the set-back produced by the sudden acceleration forces the hinged inertia weight back against its spring. The hinged inertia weight forces the locking dog from the arming-stem gear sector by means of its lever linkage, freeing the gear train. The vanes rotate, driving the electric generator and the gear train. After approximately 100 vane revolutions, the gear sector on the arming stem has rotated 25 degrees clockwise to move clear of the gear train. As the gear sector clears the gear train, the tension spring snaps it 75 degrees clockwise, where it is detained by the stop pin on the hinged inertia weight. Since the arming stem and detonator rotor are integral with the gear sector, they also move 25 degrees by vane rotation and 75 degrees by spring action. The vanes continue to rotate, driving the generator and the gear train, which is disconnected from the arming stem. As acceleration ceases at the end of burning of the motor, the spring forces the hinged inertia weight forward, pulling the stop pin and freeing the gear secor. The tension gear snaps the gear sector 90 degrees clockwise into the armed position, lining up the detonator with the booster lead-in and making electrical connection to the firing circuit. The detonator is locked in position by a spring-loaded detent in the detonator rotor. When the electric detonator is connected to the firing circuit, the firing condenser is charged. After 0.7 to 1.4 seconds, the condenser has stored up sufficient power and the fuze is armed. On approach to a target, the V.T. element activates the firing circuit, which discharges the condenser through the electric detonator which initiates the explosive train.

Remarks: Each V.T. Fuze Mk 172 Mod 0 is shipped as a complete unit including a seal wire and booster safety pin. It will be recalled that the booster safety pin in this application, like that on the bomb fuzes, gives a visual indication that the detonator rotor is in its original or safe position, if, upon removal of the pin, it can be fully reinserted. If it cannot be reinserted, the detonator rotor will have moved out of position and, hence, the fuze should be disposed of.

The V.T. Fuze Mk 172 Mod 0 has neither self-destructive nor impact-functioning features. However, if the V.T. fuze is a complete dud, the Base Fuze Mk 157 Mod 0 will cause detonation after impact. While the V.T. Fuze Mk 172 Mod 0 is designed primarily for air-to-ground firing, it could be used, though less effectively, for air-to-air firing. In this application, the rocket would have to come within 20 feet of the aircraft target in order to function.

A seal wire through a hole in the arming pin inserted at the factory prevents the vanes from rotating and insures that the arming mechanism is in the proper position. Any turning of the vanes, unless accompanied by set-back, will cause the rotor system to jam, stripping its gears, so that the fuze will be a dud. For this reason, the fuze cannot be pre-armed.

If the seal wire is broken when the fuze is originally removed from the container, do not use the fuze. Fuzes in this condition could be disposed of in accordance with security regulations by lowering in deep water or by explosive demolition.

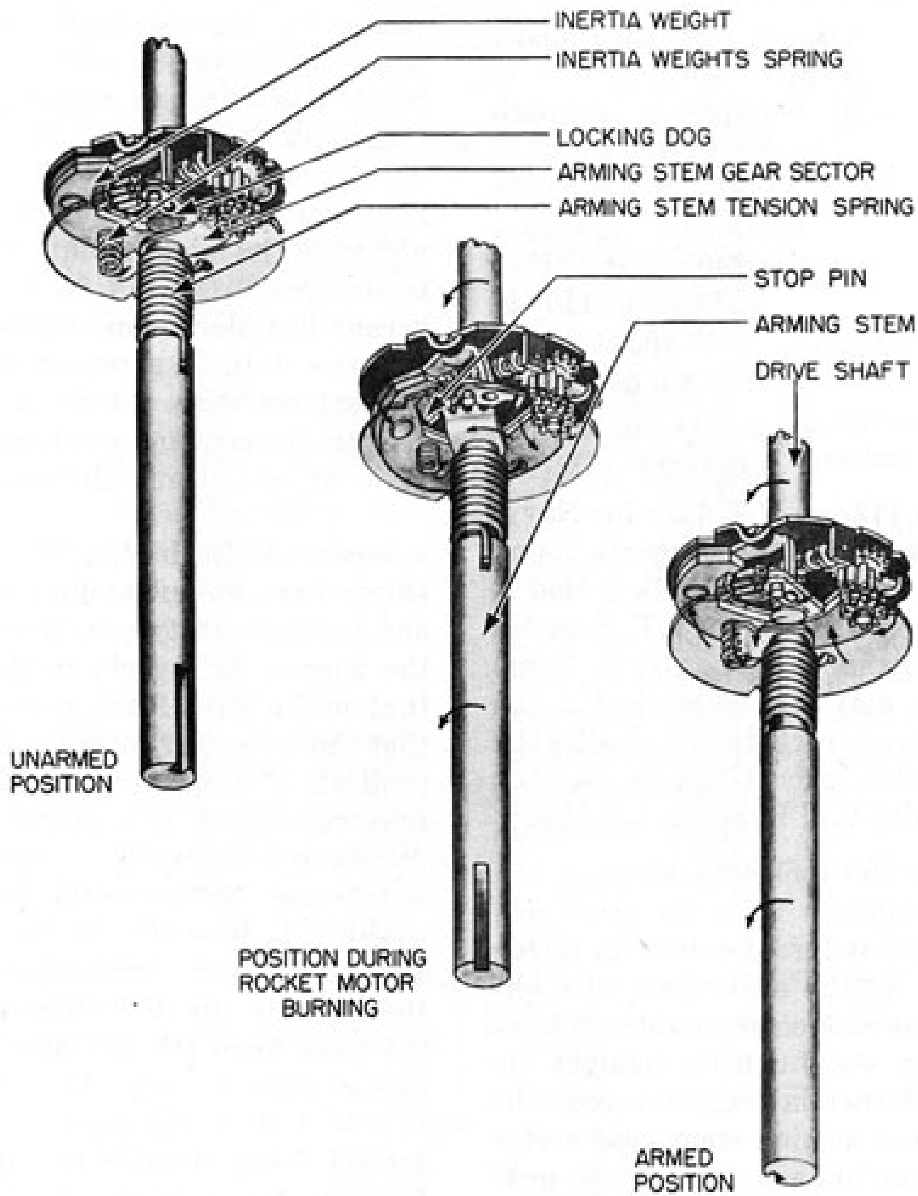


Figure 160. V.T. Fuze Mk 172 Mod 0 — Mechanical Arming Device

High-speed rotation of the vanes is necessary to produce the current to fire the fuze. Therefore, the fuze is actually armed only when in flight on the rocket at speeds in excess of 80 knots. Damaged fuzes may hold the electrical charge in the condenser for quite some time. For this reason, damaged fuzes and duds found on the ground should preferably be handled with care.

No disassembly of the V.T. Fuze Mk 172 Mod 0 is authorized by field personnel.

The V.T.Fuze Mk 171, four times as sensitive as the Mk 172, was designed for plane-to-plane firing; but, because of poor results in this technique of firing, few of these fuzes were produced.

NAVY BASE FUZES

Mk 31 and Mk 36

Rockets used in	5.0-inch Mk 8
Functioning	Mk 31—non-delay Mk 36—0.01 sec. delay
Body diameter, inches	1.8
Over-all length, inches	4.68

General: The Navy Rocket Base Fuze Mk 31 is identical to the Navy Base-Detonating Projectile Fuze Mk 31. This fuze is armed by centrifugal force and thus can only be used in spin-stabilized rockets. The fuze is designed for instantaneous action on impact. It is shipped installed in the base of the rocket body.

Description: The fuze is composed of two major parts: the fuze body and the noze cap. The body contains the auxiliary detonator plunger, the detonator plunger, the detonator-plunger detents, the anti-creep spring assembly, and the firing train. The auxiliary detonator plunger is surrounded by twenty ball bearings and bears against the bottom of the detonator plunger. Fitted over the top of the detonator plunger is the anti-creep spring assembly consisting of an inner and outer cup separated by an anti-creep spring. The outer cup will not move, and the inner cup is crimped over the top of the detonator plunger and held in position by the sensitive primer holder. The firing train consists of the sensitive primer, plunger firing pin, secondary primer, detonator, and booster lead-ins and lead-outs, which are out of line in the unarmed position.

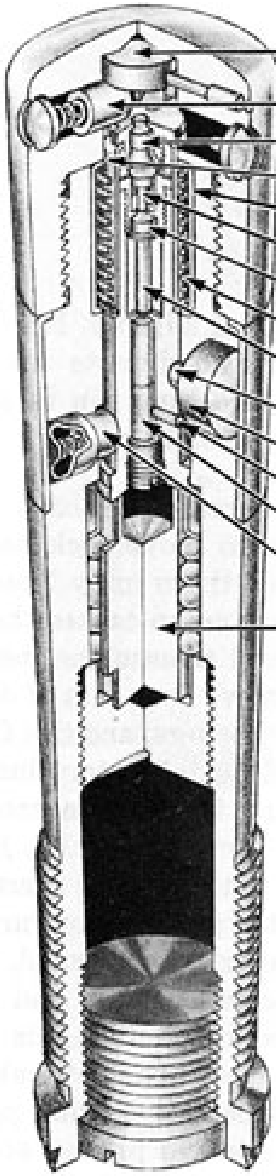
The nose cap, which is secured to the end of the body by a threaded joint, houses the sensitive firing pin and firing-pin detents. The sensitive firing pin is held in place by two stakes, but is referred to as a "floating" firing pin, since it can move downward slightly. Ninety degrees removed from the two detents are two holes in the nose cap. A locking pin is provided to lock the nose cap in position.

Operation: The force of set-back causes the sensitive firing pin to move back on the firing pin detents and hold them in by friction. When the motor burns out, creep causes the firing pin to move forward and release the detents. Centrifugal force will move both sets of detents outward against their springs, and the fuze is then completely armed. The detonator plunger is prevented from moving forward on creep because of the anti-creep spring; but on impact the auxiliary plunger, acting as an inertia weight, pushes the detonator plunger forward. This action moves the inner cup forward, thus compressing the anti-creep spring, and brings the booster lead-ins and lead-outs in line. The sensitive primer in the top of the detonator plunger is carried on to the sensitive firing pin, and the explosion of the sensitive primer accomplishes two things:

1. The gases resulting from the explosion pass through the port holes on the side of the primer container and build up a high pressure, expanding that part of the cup which is adjacent to the holes in the nose cap. This action locks the detonator plunger in the fired position and keeps the firing train lined up.

2. The shear wire that has been holding up the secondary firing pin is broken, and the secondary firing pin is driven down into the secondary primer, and the flash sets off the detonator and booster elements.

Remarks: The Base Fuze Mk 36 differs from the Mk 31 only in that it has a 0.01 second delay element housed in the space which is the flash channel in the Mk 31.



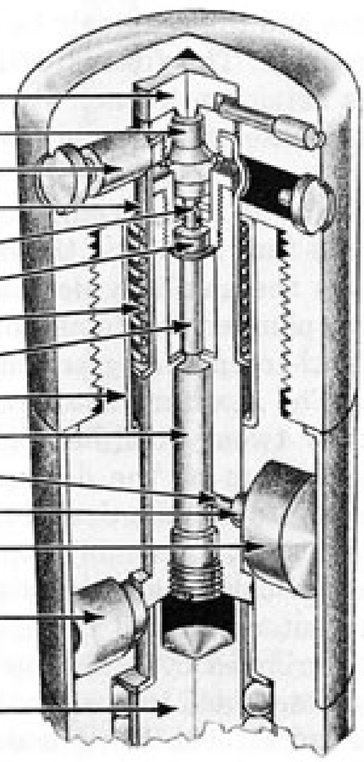


Figure 161. Navy Base Fuzes (Rocket) Mk 31 and Mk 36

Mk 134

Rockets used in. .3.5-inch Window and Flare
Over-all length, inches 1.28
Diameter, inches 2.875
Material . . . . Plastic
Fuzes used with . . . . None
Functioning . . . . Safety-fuze delay 15 seconds

Descriptions: The Base Fuze Mk 134 consists of a molded plastic case in which a length of Ensign Bickford safety fuse is coiled with a cap

on one end and a 20-gram charge of black powder on the other.

Operation: Blast from the motor impinges and fires the cap. The cap sets off the fuse which burns for 15 seconds before the burning gets to the black-powder charge. Explosion of the black powder expels the window load through the forward end of the rocket.

Mk 146 and Mk 146 Mod 1

Rockets used in....3.5-inch Head Mk 4
5.0-inch Head Mk 1
7.2-inch D.R. Head Mk 10

Functioning ....Non-delay

Fuzes used with.......Alone or with Mk 149 or Mk 148

Arming Time....From ignition of propellant to 0.1 second after acceleration ceases

Body diameter, inches..................2.88

Over-all length, inches................5.50

General: The fuze head screws into an adapter fixed in the base of the rocket body, and the gasket and luting on the threads make a gas-tight seal. The top of the fuze is exposed to the front end of the rocket motor. The Base Fuze Mk 146 Mod 1 differs in that it has a more sensitive firing train. These fuzes are being replaced in the 5.0-inch rocket by the Base Fuze Mk 157 Mod 0. The Base Fuze Mk 146 Mod 1 is being replaced in the 7.2-inch Demolition Rocket Head Mk 10 Mod 1 by the Mk 161 Mod 0. The fuze is shipped assembled in the base of the rocket head, and is not to be removed.

Operation: When the rocket is fired, gas under considerable pressure from the rocket motor passes through the inlet screen underneath the inlet screw and enters the pressure chamber. As the gas pressure builds up, the diaphragm bears against the arming plunger, breaking the shear wire and forcing the arming plunger inward. The locking ball, which is preventing the rearward movement of the striker block, is forced over by the pressure of the spring-loaded striker block into the narrow portion

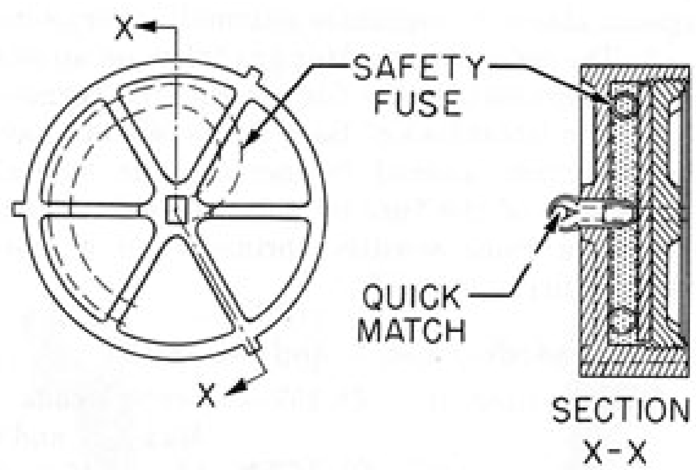


Figure 162. Navy Base Fuze (Rocket) Mk 134

of the arming plunger. The striker spring forces the striker block rearward, retracting the firing pin from the detonator shutter. The shutter is still prevented from moving across the fuze by action of its spring until after deceleration begins, since the force of set-back thrusts the shutter back and causes the shutter locking pin to engage in a recess in the firing-pin guide. After burning of the propellant ceases and deceleration begins, the shutter rides forward, disengaging the locking pin from the guide. The shutter spring forces the shutter across the shutter cavity, where it is locked in the armed position by a detent which is housed in the firing-pin guide and which engages a recess in the shutter. On impact, inertia drives the striker block forward against its spring, the firing pin striking the detonator.

Remarks: A few of the early experimental models incorporated a delay of 0.02 second to allow penetration. The Base Fuze Mk 157 was developed from these. The later models of this fuze have undergone the following modifications:

1. The inlet shield has been modified. The two outside legs are slightly longer than the flat base of the shield, so that the inlet screen will not be crushed when the inlet screw is tightened.

2. The ball retaining plug, staked in place, has replaced the screw plug.

3. A safety pin has been fitted below the

spacer sleeve to facilitate assembly operations.

4. The detonator shutter has taken on an oval shape, eliminating the former squared corners.

5. The latest lots of Base Fuzes Mk 146 have been further altered to increase the over-all sensitivity of the fuze by using a weaker creep spring, a more sensitive primer, and a more tapered firing point.

Mk 157 Mods 0 and 1, and Mk 159

Rockets used in...Mk 157—5.0-inch Heads Mks 1, 5, and 6
Mk 157 Mod 1—11.75-inch Head Mk 1

Functioning......Mk 157—0.02-second delay on impact

Arming time........Armed 0.1 second after acceleration ceases

Body diameter, inches.............2-15/16

Over-all length, inches...............5-1/2

General: The Base Fuze Mk 157 Mod 0 is essentially similar to the Base Fuze Mk 146, with the following differences: (1) a 0.02-second delay detonator replaces the non-delay detonator of the Mk 146; (2) the firing pin and the firing-pin body are pinned together by a thin lock wire. The Base Fuze Mk 157 Mod 0 has been developed to afford greater penetration of the target than was possible with the non-delay detonator of the Base Fuze Mk 146. The Base Fuze Mk 157 Mod 0 is being replaced by the Mk 165 Mod 0,

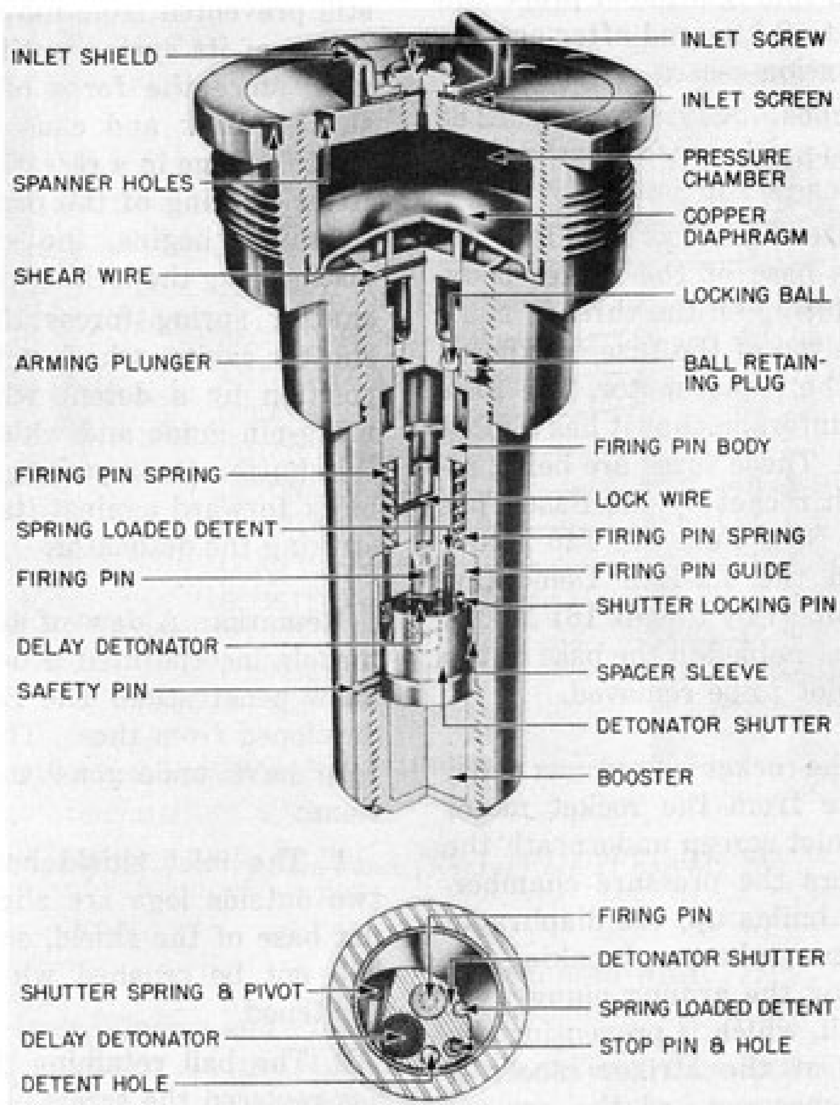


Figure 163. Navy Base Fuze (Rocket) Mk 157 Type

which consists of the Mk 157 Mod 0 with a motor adapter and an improved detonator-shutter locking arrangement.

The Base Fuze Mk 157 Mod 1 differs from the Mk 157 Mod 0 in that the material for the fuze body has been considerably strengthened, and the number of external threads has been approximately doubled. In all other respects, the fuzes are identical.

Mk 159: The Base Fuze Mk 159 is similar to the Mk 157, except that the delay time has been changed to 0.015 second. The fuze is used in the base of the 5.0-inch Rocket (5.0-inch Motor—Heads Mks 5 and 6). Other minor structural changes have been made as follows: (1) a slightly heavier shear wire is used; (2) the inlet screen and inlet washer have been replaced by a brass washer having one side flat and the other radially serrated (the radially serrated side faces the fuze head, so that the motor gases can enter the fuze diaphragm chamber); (3) the number of external threads on the body has been increased and "run out" just below the flange to afford a snug fit for the sealing washer, and (4) the fuze has been completely waterproofed. The Base Fuze Mk 159 is shipped to the field installed in the base of the rocket head.

Remarks: The sensitivity of the Base Fuze Mk 157 Mod 0 is somewhat less than that of the Base Fuze Mk 146, since the percussion-type primers used in delay explosive trains are inherently less sensitive than the "stab"-type primer caps used in instantaneous detonators.

The Base Fuzes Mk 157 Mod 0 and Mk 157 Mod 1 are always shipped to the field installed in the base of the rocket.

No attempt should ever be made to remove this fuze from the assembled round for any purpose prior to firing, e.g., to clean the fuze or substitute a base plug for the fuze. Anything less than a perfect seal between the fuze and the adapter in the base of the rocket body will allow the gases from the rocket motor to seep into the body and contact the H.E. filling. Premature explosion of the rocket is then highly probable.

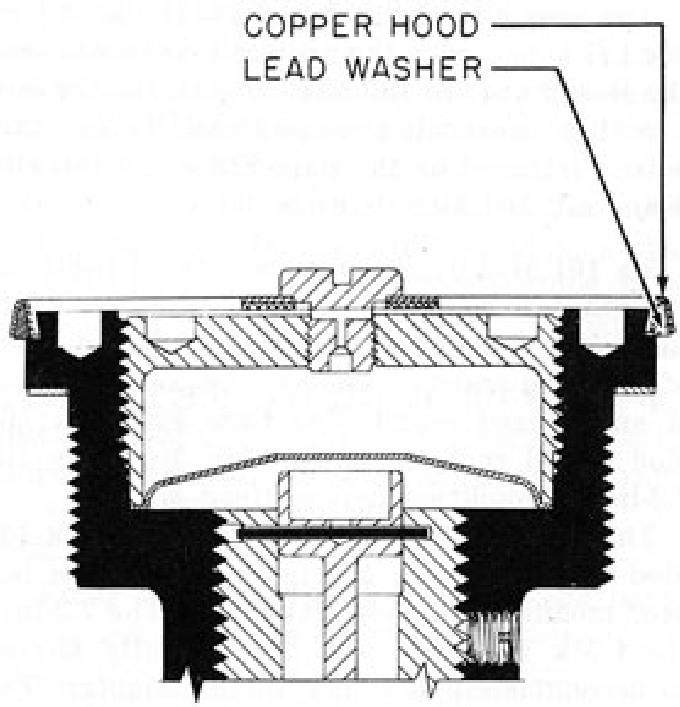


Figure 164. Gas Check for Navy Fuzes Mk 157 Mod 2, Mk 159 Mod 1, Mk 163, and Mk 164

Mk 157 Mod 2, Mk 159 Mod 1, Mk 161, Mk 163, Mk 164, and Mk 165

Rocket heads used in:

Mk 157 Mod 2. . . . 11.75" Mk 1 Mod 1, Mk 2
Mk 159 Mod 1. . . . 5.0" Mk 6 Mod 1
Mk 161 Mod 0. . . . 7.2" D.R. Mk 10 Mod 1
Mk 163 Mod 0. . . . 11.75" Mk 1 Mod 1, Mk 2
Mk 164 Mod 0. . . . 5.0" Mk 6 Mod 1
Mk 165 Mod 0. . . . 5.0" Mk 1

Functioning:

Mk 157 Mod 2, Mk 163 Mod 0, Mk 165 Mod 0 . . . . 0.2 sec. delay
Mk 159 Mod 1, Mk 164 Mod 0 0.015 sec. delay
Mk 161 Mod 0. . . . . Non-delay

Mk 157 Mod 2 and Mk 159 Mod 1: In order to secure a more adequate sealing for the protection of the explosive in the 11.75-inch and 5.0-inch rocket heads from the hot gases during the burning of the motor, the base fuzes were modified in that a projectile-type gas check was added around the fuze body ahead of the threads. The fuzes are shipped assembled in the base of the head. The lead washer with copper hood is pressed into place at the loading activity, and is not to be disturbed in the fields.

The Base Fuze Mk 157 Mod 2 is the Base Fuze Mk 157 Mod 1 with the projectile-type gas seal; the Base Fuze Mk 159 Mod 1 is the Mk 159 Mod 0 with a projectile-type gas seal. These fuzes will be replaced by the Base Fuzes Mk 163 Mod 0 and Mk 164 Mod 0 respectively.

Mk 161 Mod 0: This fuze was developed from the Mk 146 Mod 1 to secure better sealing of the motor gases from the high-explosive filling of the head and to eliminate the possible firing of an unfuzed round. The Base Fuze Mk 161 Mod 0 will replace the Mk 146 Mod 1 in the 7.2-inch Demolition Rocket Head Mk 10.

The Mk 161 Mod 0 differs from the Mk 146 Mod 1 only in that the head of the fuze has been modified to receive the motor. The 7.2-inch Head Mk 10 Mod 1 has been slightly altered to accommodate the new motor adapter. The 3.25-inch motor will thread into the fuze, and a threaded reducer is supplied to permit use of the 2.25-inch motor.

Mk 163 Mod 0 and Mk 164 Mod 0: The Base Fuze Mk 163 Mod 0 is similar to the Mk 157 Mod 2, and the Mk 164 Mod 0 is similar to the Mk 159 Mod 1. In addition to retaining the projectile-type gas seal previously mentioned, the Base Fuzes Mk 163 Mod 0 and Mk 164 Mod 0 have an improved detonator-shutter locking arrangement. Formerly, the shutter was retained in the safe position by a projection which locked in a recess of the body during set-back, and was held in that position by the force of acceleration during the burning of the motor. This allowed the detonator upward movement as well as rotation, which contributed to the malfunctioning of the earlier fuzes.

The new design has removed the projection and replaced it with a shutter lock pin which is mounted in a set-back block. The block is retained in position by a set-back block spring. As the rocket is launched, the force of set-back moves the block back to compress the set-back block spring. The lock pin moves up to contact the detent, to move upward and compress the detent spring. As the motor burns, the firing pin is withdrawn from the shutter, to leave only the lock pin to prevent the shutter from pivoting. As the motor burns out and deceleration sets in, the set-back block spring and the detent spring force the set-back block forward, thereby withdrawing the lock pin from the shutter. This frees the detonator shutter, and the spring acts to pivot the shutter over in the cavity and align the firing train.

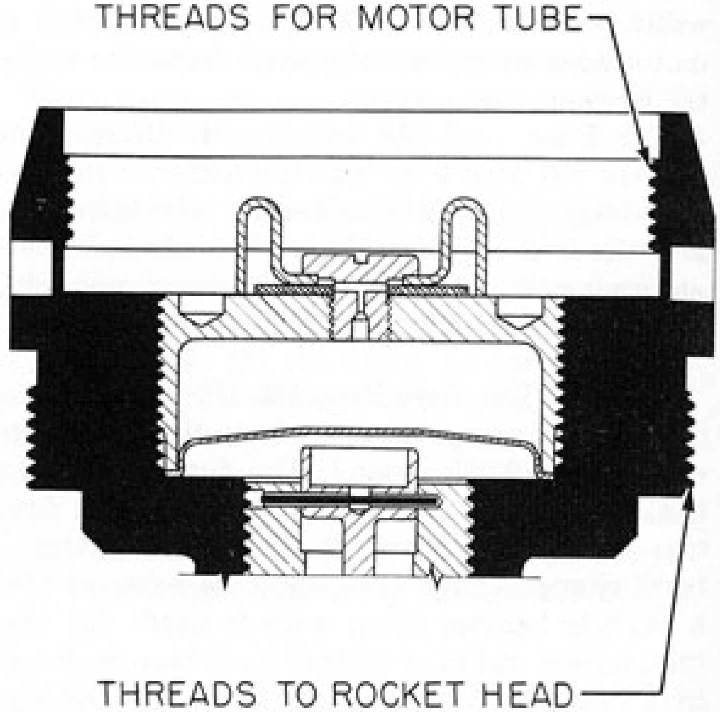


Figure 165. Motor Adapter in Fuzes Mk 161 and Mk 165

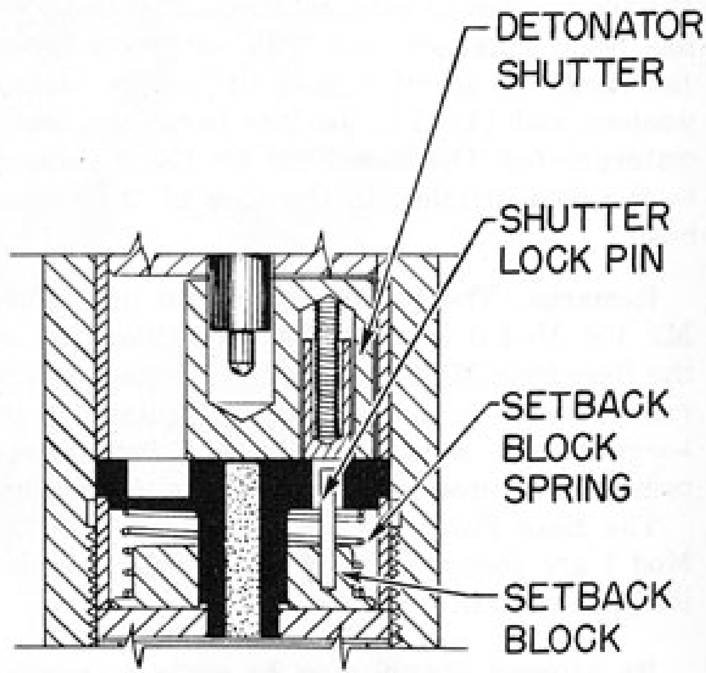


Figure 166. Modified Detonator Shutter Lock for Fuzes Mk 163, Mk 164, and Mk 165

Mk 163 Mod 1: This fuze differs from the Mod 0 in that the diameter of the inlet orifice has been decreased and the diameter of the shear wire increased, to increase the arming pressure to 350 pounds per square inch.

The Base Fuze Mk 163 Mod 0 will replace the Mk 157 Mod 2 in the 11.75-inch Heads Mk 1 Mod 1 and Mk 2; the Base Fuze Mk 164 Mod 0 will replace the Mk 159 Mod 1 in the 5.0-inch Head Mk 6 Mod 1.

Mk 165 Mod 0: This fuze differs from the Base Fuze Mk 157 Mod 0 only in that the head of the fuze has been modified to receive the motor and the booster is approximately 0.3 inches longer, to incorporate the improved detonator-shutter locking arrangement described under the Base Fuzes Mk 163 Mod 0 and Mk 164 Mod 0.

The adapter in the fuze head is threaded to receive the 3.25-inch Motor Mk 7, and the Base Fuze Mk 165 Mod 0 will replace the old motor adapter in the base of the 5-inch Head Mk 1, as well as the Fuze Mk 157 Mod 0.

Mk 162 and Mk 166

Rockets used in	Mk 162—11.75″ A.R. Mk 166—5.0″ Head Mk 2 Mod 2
Functioning	Mk 162—pyrotechnic delay of 0.01 sec. Mk 166 — Instantaneous explosive train
Arming distance, feet	Mk 162—420 to 550 Mk 166—450 to 580
Over-all length, inches	Mk 162—6.800 Mk 166—6.490
Body diameter, inches	Mk 162—2.750 Mk 166—2.125

General: These fuzes were designed primarily to be used against marine targets. They will not detonate immediately after impact with water, but will allow the rocket to continue on its underwater trajectory. If the rocket strikes the hull of a ship above water or under water, the fuze will detonate the rocket after penetration of the hull is completed. If the rocket misses the ship, however, the fuze fires after approximately 150 to 200 feet of underwater travel. Upon penetration of very heavy fortifications, the fuze does not function after fixed pyrotechnic delay but automatically varies the delay in firing mechanically, so that it does not fire until penetration of the target is completed or, if the target is too heavy, until the rocket stops. It is in this manner that the fuze is discriminating.

Operation: The operation of this fuze is divided into five stages: (1) gas pressure effect; (2) rotation causing alignment of firing train in a vertical plane; (3) creep; (4) impact; (5) firing.

FIRST STAGE—After the round has been fired, gases from the burning motor enter through the inlet filter, pass through the orifice in the inlet screw, and exert sufficient force to open the inlet valve. The gases accumulate and build up pressure in the upper chamber. Because of the differential pressure between upper and lower chambers, the gases seep through a small orifice in the baffle cup into the lower chamber. Upon the completion of burning of the motor, the pressure of the gases in the upper chamber is above the remaining motor pressure, and therefore forces shut the inlet valve. The gases from the upper chamber continue to seep into the lower chamber, tending to equalize the pressure between chambers. When the pressure in the lower chamber is sufficient, the diaphragm collapses, forcing the arming sleeve forward and shearing the shear wire.

SECOND STAGE—The rotor, which has been kept from turning by the shear wire, is now free to rotate under the force of the rotor spring. The detonator plunger is attached to the rotor through a detonator-plunger pin, which rides in a vertical groove in the rotor. The trigger block likewise is attached to the rotor through trigger-block rotating pins. Thus, as the rotor turns in a clockwise direction, so do the detonator plunger and trigger block assemblies. Rotation continues for 90°, at which point the rotor is stopped by the rotor stop pin. This aligns the firing train in a vertical plane. The grooves in the detonator plunger are now aligned with two stop pins.

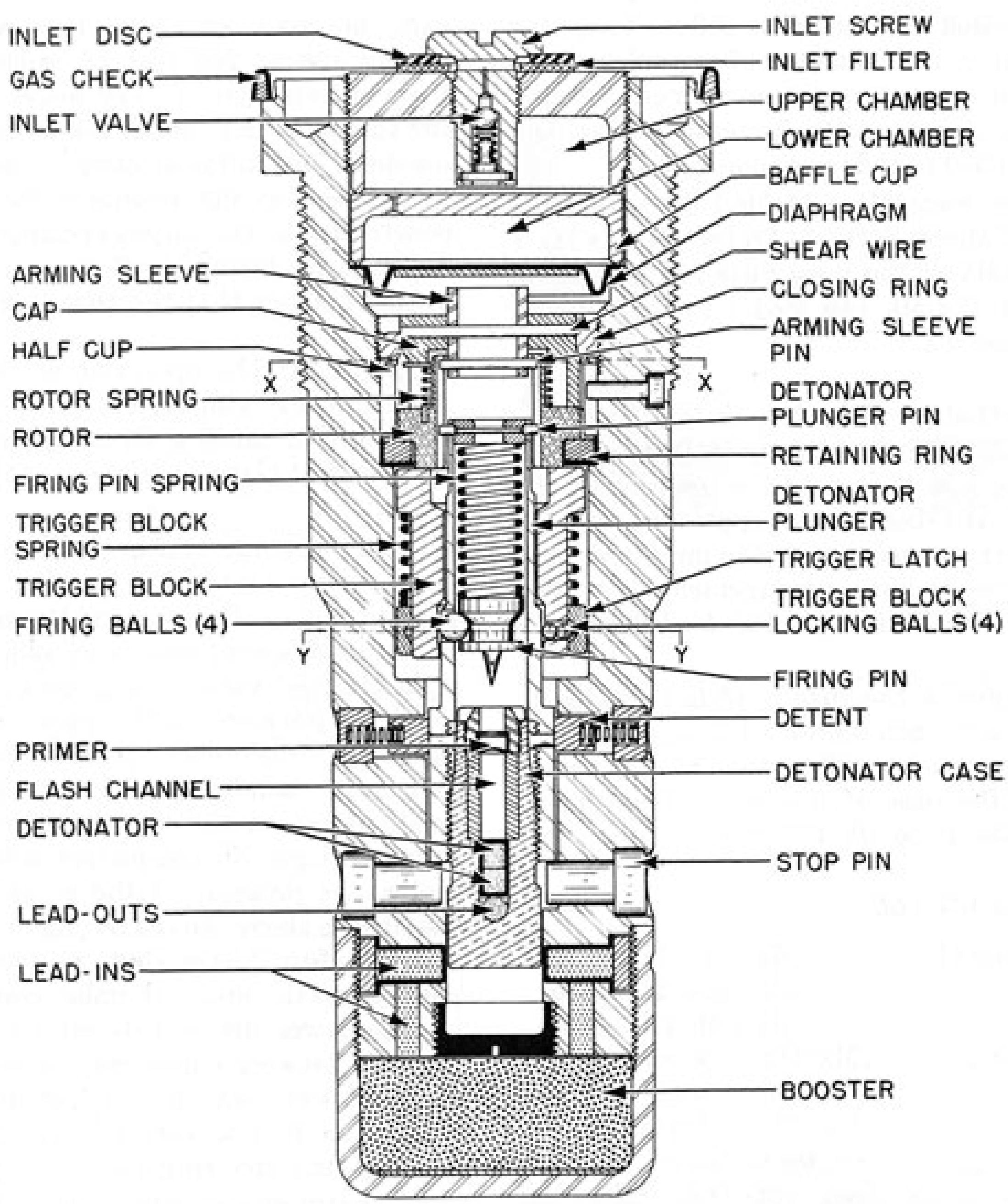


Figure 167. Navy Base Fuze (Rocket) Mk 166 (Assembly)

THIRD STAGE—Upon the completion of burning of the rocket motor and completion of the rotation of parts discussed in the second stage, the force of creep causes the detonator plunger and trigger block assembly to move forward, the rotor being held in position by the retaining ring. The trigger block continues to move forward until it engages a shoulder in the fuze body. As the detonator plunger is attached to the trigger block by four firing balls, further movement of the detonator plunger also ceases as the trigger block engages the fuze body. The firing train is prevented from getting out of line in a vertical plane by the stop pins which ride in grooves in the detonator plunger and prevent further rotation of the detonator plunger. Up to this point of the operation, the lead-outs are not yet in complete alignment with the lead-ins in a horizontal plane.

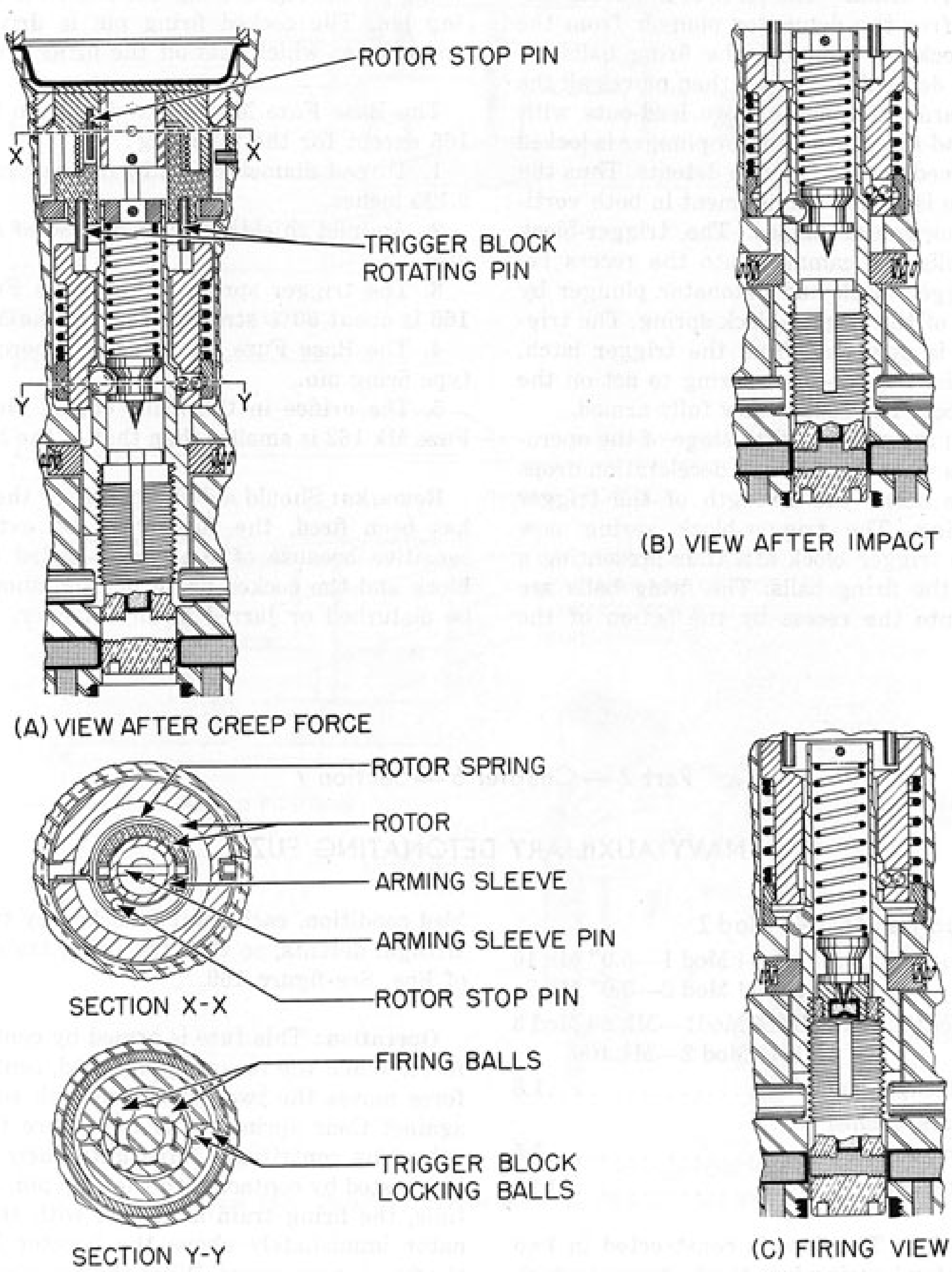


Figure 168. Navy Base Fuze (Rocket) Mk 166 (Details)

FOURTH STAGE—The force of impact is sufficient to free the detonator plunger from the trigger block by camming the firing balls inward. The detonator plunger then moves all the way forward, aligning the two lead-outs with the two lead-ins. The detonator plunger is locked in the aligned position by two detents. Thus the firing train is locked in alignment in both vertical and horizontal planes. The trigger-block locking balls are cammed into the recess between trigger block and detonator plunger by the action of the trigger-block spring. The trigger block is now free from the trigger latch, allowing the trigger-block spring to act on the trigger block. The fuze is now fully armed.

FIFTH STAGE—The fifth stage of the operation occurs when the force of deceleration drops to a value below the strength of the trigger block spring. The trigger-block spring now forces the trigger block aft, thus presenting a recess to the firing balls. The firing balls are cammed into the recess by the action of the firing-pin spring, freeing the sensitive-type firing pin. The cocked firing pin is driven into the primer, which sets off the firing train.

The Base Fuze Mk 162 is similar to the Mk 166 except for the following:

1. Thread diameter of 2.75 inches instead of 2.125 inches.
2. An inlet shield is issued instead of an inlet disc.
3. The trigger spring of the Base Fuze Mk 166 is about 50% stronger than in the Mk 162.
4. The Base Fuze Mk 162 has a percussion-type firing pin.
5. The orifice in the baffle cup of the Base Fuze Mk 162 is smaller than that of the Mk 166.

Remarks: Should a dud occur after the round has been fired, the fuzes may be extremely sensitive because of the spring-loaded trigger block and the cocked firing pin and should not be disturbed or jarred in any manner.

Part 2 — Chapter 6 — Section 7

NAVY AUXILIARY DETONATING FUZE

Mk 44 Mod 1 and Mk 44 Mod 2

Heads used in.....Mk 44 Mod 1—5.0″ Mk 10
Mk 44 Mod 2—5.0″ Mk 7

Fuzes found with. Mk 44 Mod1—Mk 30 Mod 3
Mk 44 Mod 2—Mk 100

Over-all length, inches....................1.8

Diameters, inches
Rotor housing........................1.5
Booster cup..........................1.25

Description: The fuze is constructed in two parts, a rotor housing into the bottom of which is screwed a booster cup. The rotor housing contains a double rotor, one rotor above the other. The upper rotor contains a primer detonator incorporating lead azide. The lower rotor contains a booster lead-in of tetryl. In the assembled condition, each rotor is locked by two centrifugal detents, so that the firing train is out of line. See figure 169.

Operation: This fuze is armed by centrifugal force. When the rocket is launched, centrifugal force moves the two detents on each rotor out against their springs. The rotors are then revolved by centrifugal force until their motion is arrested by contact with the stop pin. At that time, the firing train is in line, with the detonator immediately above the booster lead-in; the fuze is now armed. When the nose fuze functions, the gas pressure generated at that time forces through the weakened part of the closing disc to fire the detonator. The firing train is then as follows: booster lead-in, booster, and main charge.

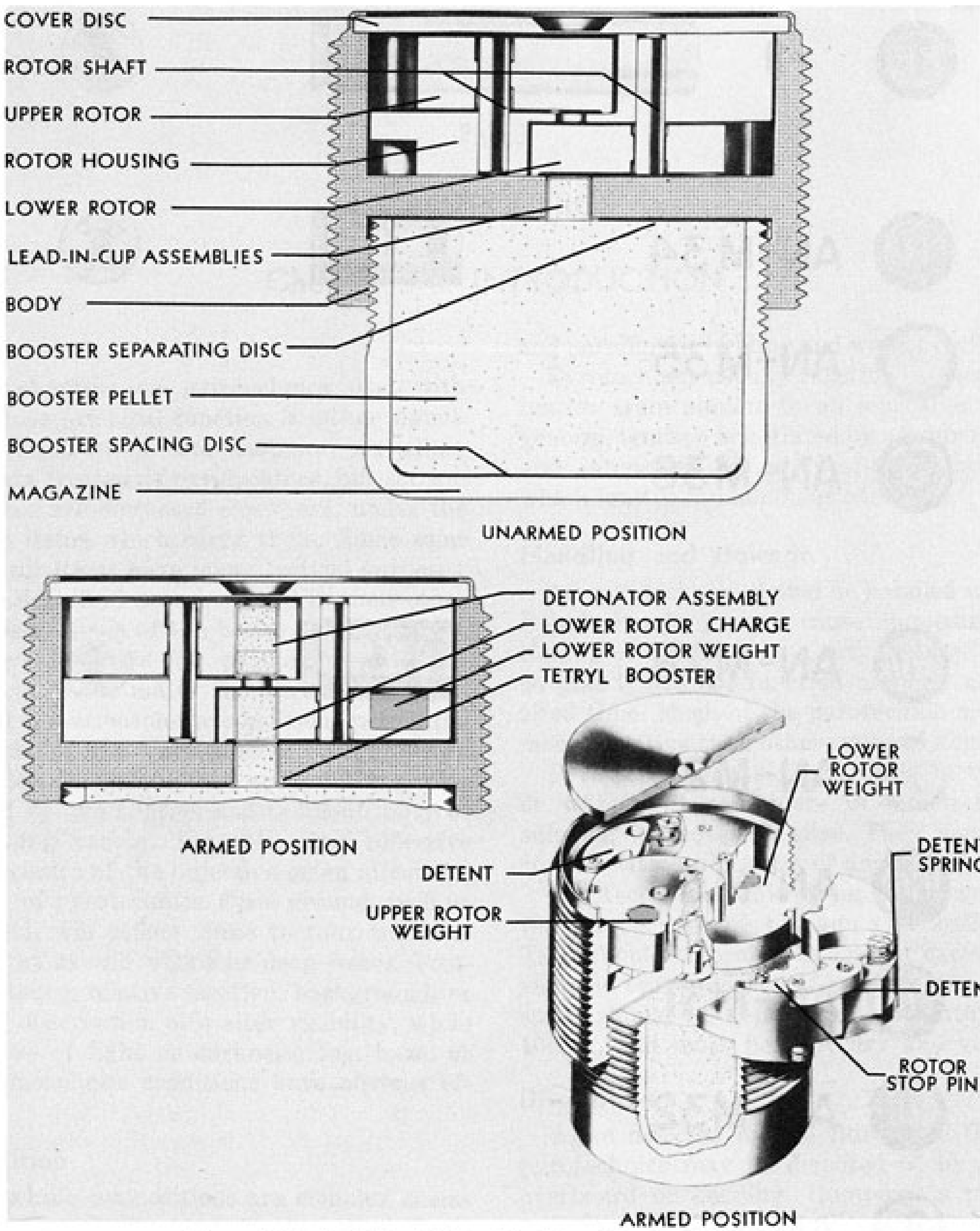


Figure 169. Auxiliary Detonating Fuze (Rocket) Mk 44 Type

Mk 44 Mod 2: The Auxiliary Detonating Fuze Mk 44 Mod 2 is the same as the Mk 44 Mod 1, except that the hole in the closing disc over the detonator is drilled completely through and a copper sealing disc, 0.02 inch thick, is placed over the closing disc.

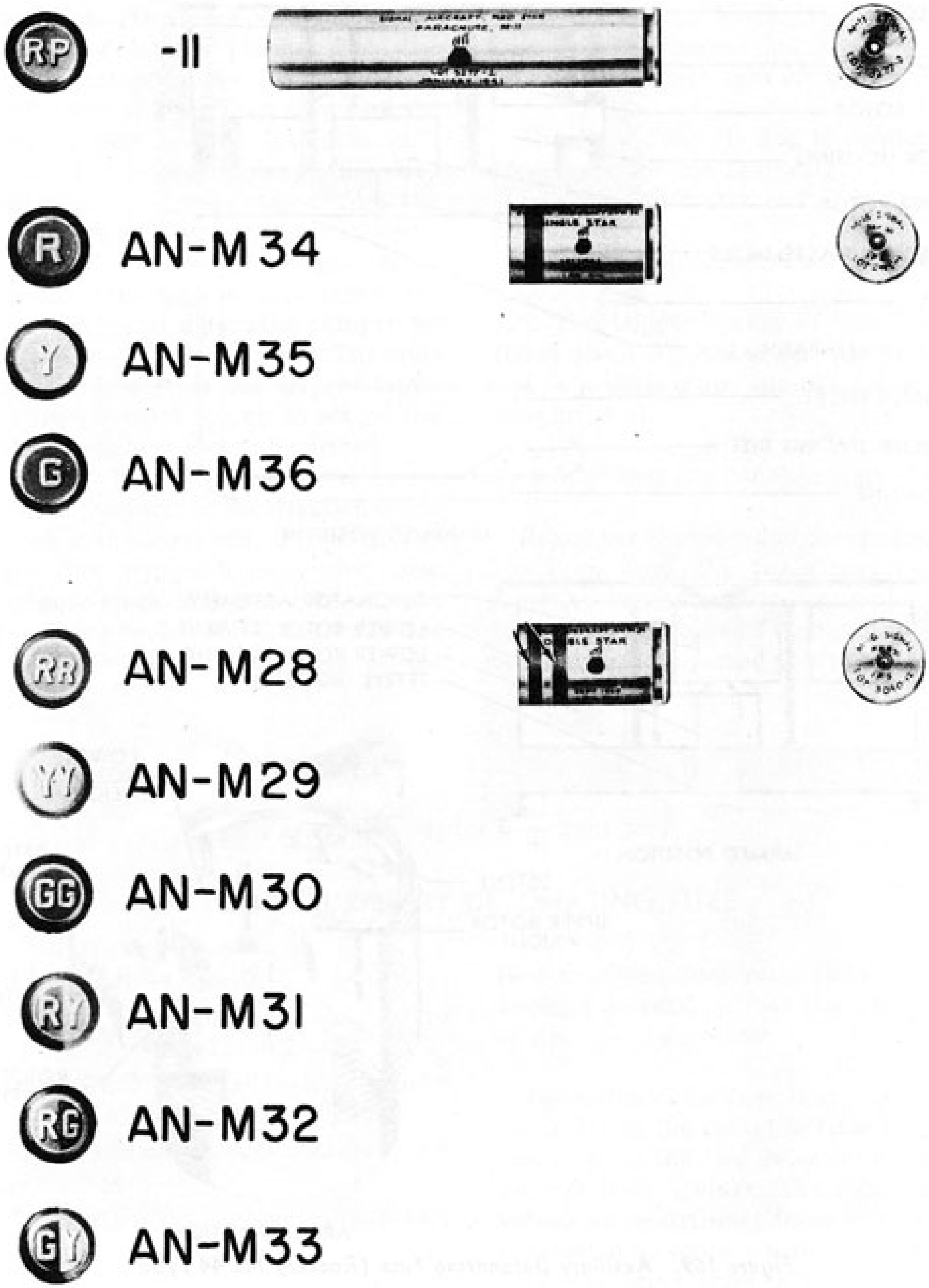


Figure 170. Cartridge Signals M11 and AN–M28 to 33 Series

Part 3

PYROTECHNICS

Chapter 7 — INTRODUCTION

General

These chapters on pyrotechnics deal with items whose principal function is either signalling or illuminating. For instance, signalling smokes are treated as pyrotechnics, but screening smokes are discussed elsewhere, under the ordnance items which carry them. Since some pyrotechnic items have many tactical purposes, they are described both here and in their other applicable sections of the book.

The effectiveness of pyrotechnics is dependent on three major factors: design, position, and the atmospheric conditions prevailing at the time of use. Variations of design govern the candlepower of the flare or signal, the color produced by the charge, and the continuity of the burning candle. The color and reflective characteristics of the objective often affect the visibility of pyrotechnics. Open ground, such as an airfield, will reflect three to four times as much light as will woods or deep water. Position, distance, relative position, background, or angle of observation also alter visibility, while the degree of light or darkness, fog, haze, or other atmospheric conditions have obvious effects.

Composition

Pyrotechnic compositions are complex chemical mixtures. On burning, they produce illuminations ranging in intensity from the "dark fire" used as an element of blinker signals to the brilliant flash produced by the photoflash bombs. Standard pyrotechnics, in general, consist of compounds to provide oxygen for burning, such as chlorates and nitrates; aluminum or magnesium for fuel; salts of barium, copper, or strontium for color; and agents such as asphalt and paraffin for binding and waterproofing.

Pyrotechnics usually function by means of an igniter train similar to an explosive train. In general, ignition is initiated by a primer mixture and intensified by a "first-fire" composition which ignites the luminous candle.

Handling and stowage

All pyrotechnics should be handled with care. Rough handling may cause immediate functioning of the item, or it may damage the item so that it will not function properly at the desired time. Much of the pyrotechnic material is more sensitive than other types of ammunition.

Pyrotechnics should be stowed in the boxes or watertight containers in which they are shipped, whenever possible. They must not be stowed with other types of ammunition.

Pyrotechnics should never be stowed where the direct rays of the sun can strike them. They should be protected against excessive and variable temperatures. If possible, the stowage space should be kept at a temperature below 100°F., and must be kept dry and ventilated.

Disposition

When directed by the Bureau of Ordnance, pyrotechnics may be disposed of by dumping overboard or burning. Dumping is preferred, and must be done ten miles off shore and in water at least 100 fathoms deep. Certain items must always be dumped, while other items may be either dumped or burned.

Methods of projection

Aircraft pyrotechnics

1. PYROTECHNIC PISTOL AN–M8—This pistol is used on aircraft with the Mount M1 and fires

through an opening, in the fuselage. It can also be detached from its mount and fired by hand. It is generally used for signalling from aircraft in flight, to troops on the ground or to other aircraft.

2. HAND PROJECTORS MK 3 AND MK 4—These projectors are fired by holding the barrel in one hand and pulling back on the firing pin handle with the other. They are used to fire Very's Signal Light Mk 2.

3. SIGNAL PISTOL MK 5—This is a single-action, single-loading pistol that fires the Very's Signal Light Mk 2.

4. VERY PISTOL M5—This is a single-action, single-loading pistol that fires the Very's Signal Light Mk 2. It is not procured by the Navy.

5. PYROTECHNIC DISCHARGER AN–M5—This is a double-action, multi-barrel (6) discharger used on aircraft when installation of pistols is not practicable. It is used for the same purpose as the Pyrotechnic Pistol AN–M8. It is not procured by the Navy.

6. HAND PYROTECHNIC PROJECTOR M9—This is a single-action, single-loaded projector which is fired by striking the firing pin with the hand or by striking the firing pin on the ground. It is used for projecting signals from the ground to aircraft in flight. It is not procured by the Navy.

7. PYROTECHNIC DISCHARGER M10—This is a metal cylinder with a mushroom firing mechanism and a hinged locking stem. It is used to fire the Red Star Signal M73.

Ground pyrotechnics

1. GROUND SIGNAL PROJECTOR M1A1—This is a single-loaded, manually operated projector used to fire the High-Bursting-Range Ground Signal M27.

2. GROUND SIGNAL PROJECTOR M3—This is a single-loaded, manually operated projector that is fired by holding the projector in the hand and striking the base on the ground. It is used to fire Signals M17 through M22.

3. GROUND SIGNAL PROJECTOR M4—This projector is similar to the M3 and is replacing it.

4. GRENADE LAUNCHERS M1, M2, M7, AND M8—This type of launcher is an extension to the barrel of a rifle or carbine. It is used to fire ground signal M17A1 through M22A1, M51A1, and M52A1.

5. TREE SUSPENSION DEVICE T1, FOR SMOKE GRENADE—This is a cardboard attachment containing about ten feet of suspension cord. It is attached to a standard smoke grenade that is launched from a carbine or rifle. The device is used to cause grenades to become entangled in trees or foliage, to permit emission of smoke above dense forests and foliage where it is readily visible to air observers.

Ship and submarine pyrotechnics

1. SIGNAL PROJECTOR MK 1 AND MK 1 MOD 1—This is a barrel, about 30 inches in length, which fits into a tube mounted on a three-legged stand. The firing pin is part of a metal disc which acts as a valve. It is used to fire Ship's Emergency Identification Signals Mks 1, 2, 3, and 4.

2. SUBMARINE ROCKET PISTOL—This is a single-loaded, breech-loaded pistol used to fire pistol rocket signals.

3. SUBMARINE EMERGENCY IDENTIFICATION SIGNAL EJECTOR—This ejector is similar to a miniature torpedo-tube arrangement. It is used to fire Submarine Emergency Identification Signals, Submarine Float Signal Mk 1, Mk 1 Mod 1, or Mk 2 Mod 0, and False Target Shell, Mk 1.

4. OTHER PROJECTORS—These include Hand Projectors Mk 2 and Mk 4, and pyrotechnic Pistol AN–M8, which are described above under Aircraft Pyrotechnics. There is also a High-Altitude Mortar Mk 20 being developed, to which official nomenclature-is being assigned.

AIRCRAFT PYROTECHNICS

Section I — PISTOL AND HAND-SIZE SIGNALS

Parachute Star M11, also M10, M14, M15, and M16

Length, inches	7.69
Diameter, inches	1.58
Burning time, seconds	30
Intensity, candlepower	20,000
Color	Red
Height, feet	200—250

Use: This is a distress signal from grounded planes.

Projection: The Pyrotechnic Pistol AN–M8 or Hand Projector M9 is used for firing the flare.

Description: The cylindrical, aluminum outer case has an extraction groove at the end containing the primer. A press-fit identification top is cemented to the end opposite the primer and has the embossed letters "R.P." for night identification. This cartridge is classified by the Army as the rimless type.

Operation: The firing pin of the pistol sets off the primer, igniting the propelling charge. The propelling charge ignites the delay fuse and propels the inner case outward. The delay fuse burns for 2.5 seconds and ignites the expelling charge, which in turn ignites the candle and expels the candle and parachute from the inner case.

Remarks: The Army has other parachute signals which are similar to the M11. These are obsolete or limited standard items:

	Embossed Letters
White Star, Parachute, M10	WP
White Star, Blinker Parachute, M15	WB
Green Star, Blinker Parachute M16	GB
Red Star, Cluster, M14	RS

Double-Star AN–M28 to AN–M33 Series (Obsolete)

Length, inches	3.02
Diameter, inches	1.58
Burning time, seconds	7
Altitude, feet	250

Use: Double-star aircraft signals are used as emergency identification by aircraft.

Projection: The Pyrotechnic Pistol AN–M8 or Projector M9 is used for firing the signal.

Description: The signal cartridge has an aluminum, plastic, or steel barrel with an extraction groove at the closed end which houses the primer. A press-fit identification top is cemented into the opposite end, finished with embossed letters to identify the colors of the stars. Appropriately colored bands around the outer case also identify the colors of the stars. In addition, the identification top is appropriately colored. These signals are also classified by the Army as the "Rimless Type."

	Color of Stars	Embossed Letters
AN–M28	Red-Red	RR
AN–M29	Yellow-Yellow	YY
AN–M30	Green-Green	GG
AN–M31	Red-Yellow	RY
AN–M32	Red-Green	RG
AN–M33	Green-Yellow	GY

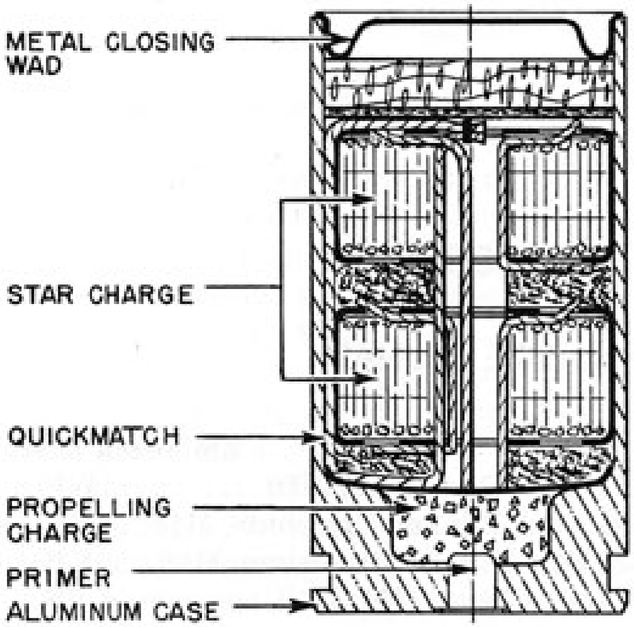


Figure 171. Cross Section of Cartridge Signal AN–M31

Operation: The firing pin of the pistol strikes the primer, igniting the propelling charge. As the stars are expelled from the pistol, they are ignited by the propelling charge through the quickmatch. The stars reach full brilliance after traveling 40 or 50 feet, and rise to a height of approximately 250 feet.

Single-Star AN–M34 to AN–M36 Series (Obsolete)

Description: This series has the single star instead of the double star of the AN–M28 to AN–M33 series, but the dimensions are the same.

	Color of Star	Embossed Letter
AN–M34	Red	R
AN–M35	Yellow	Y
AN–M36	Green	G

Remarks: This series is not procured by the Navy.

Aircraft Signals AN–M37 to AN–M42 and AN–M37A1 to AN–M42A1 Series

Length, inches	3.85
Diameter, inches	1.54
Burning time, seconds	7
Altitude, feet	250

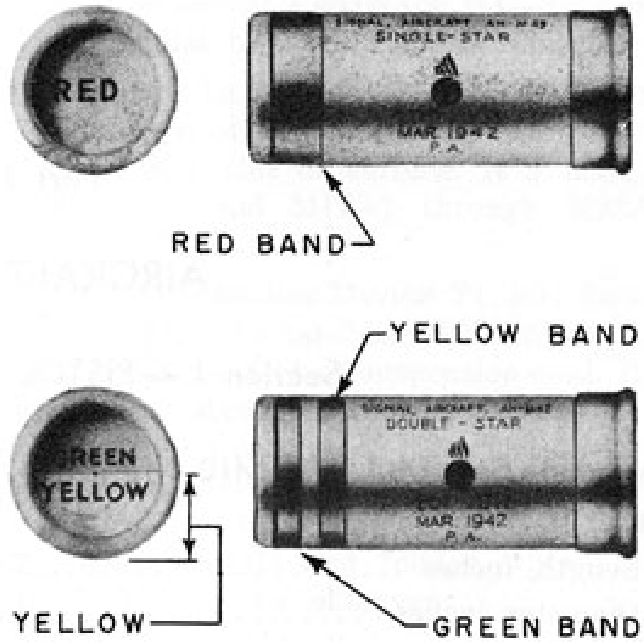


Figure 172. Aircraft Signals AN–M37 to 42 Series

Use: These signals are used for emergency identification of aircraft.

Projection: The Pyrotechnic Pistol AN–M8 is used to fire this signal.

Description: A metal or plastic head containing the primer is crimped to the paper board or metal case, the opposite end of which is closed with a cardboard wad. The colors of the stars are printed and painted on this wad, there being no means of night identification. Colors of stars are also indicated by the appropriately colored bands on the case near the forward end. These signals are classified by the Army as the Cartridge Type.

	Color of Bands and Top
AN–M37	Red-Red
AN–M38	Yellow-Yellow
AN–M39	Green-Green
AN–M40	Red-Yellow
AN–M41	Red-Green
AN–M42	Green-Yellow

Operation: These signals are similar to the AN–M28 to AN–M33 series in operation.

Remarks: The A1 series has an aluminum case.

Single-Star AN-M43 to AN-M45 and AN-M43A1 to AN-M45A1 Series

Description: This series has a single star instead of the double star of the AN-M37 to AN-M42 series; dimensions are the same.

	Color of Star and Top
AN-M43	Red
AN-M44	Yellow
AN-M45	Green

Two-Star Cartridge Mk 3 Mod 3

Description: These are interchangeable with the AN-M37 to AN-M42 series. There is no means of night identification. Color combinations available are: red-red, yellow-yellow, green-green, red-yellow, red-green, or green-yellow.

Tracer With Two Stars Mk 4 Series

Length, inches	3.85
Diameter, inches	1.52
Burning time, seconds	5
Burning time of tracer, seconds	3—4
Altitude, feet	250

Use: Double-star signals are used as a method of emergency identification of aircraft.

Projection: The Pyrotechnic Pistol AN-M8 is used to fire the signal.

Description: The outer case is similar to that of the Mk 3. The star charges are contained in an inner case which also houses an ejector charge and tracer element. Star color bands are the same as the bands on the Mk 3 and, in addi-

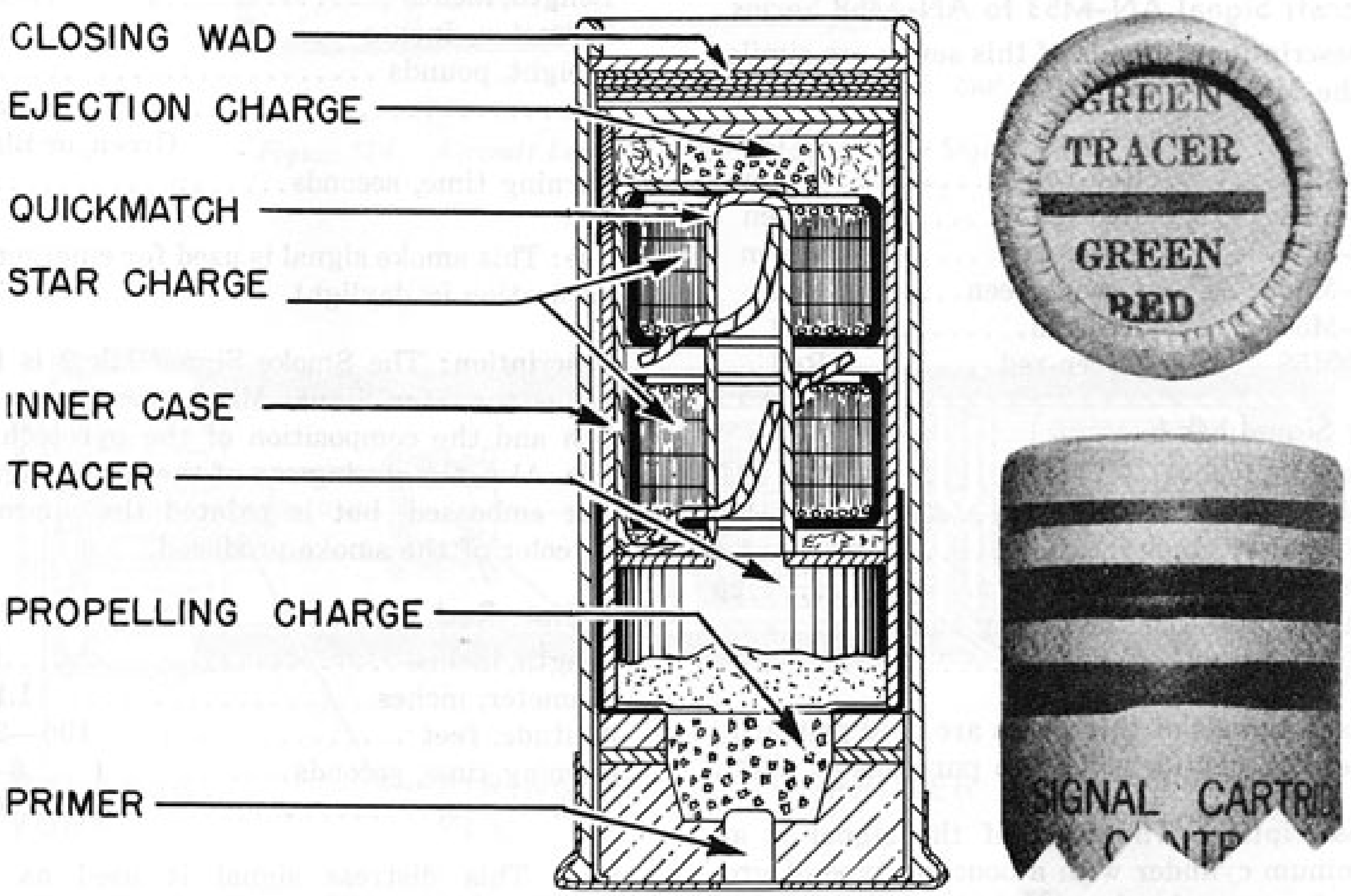


Figure 173. Tracer with Two Stars Mk 4

tion, a narrower band, before the star identification bands, indicates the color of the tracer. Color combinations are:

Red-red with red tracer
Green-green with red tracer
Red-red with green tracer
Red-yellow with yellow tracer
Red-green with red tracer
Red-green with green tracer

Operation: The firing pin strikes the primer, igniting the propelling charge, which, in turn, ignites the tracer in the inner case and expels the inner case from the barrel. The tracer becomes visible after traveling about twenty feet. At approximately 250 feet altitude, the tracer ignites the ejection charge through the quick match, the stars being ignited by the ejection charge through the quick match as they are expelled from the inner case.

Aircraft Signal AN–M53 to AN–M58 Series

Description: Signals of this series are similar to the Mk 4 series.

	Star	Tracer
AN–M53	Red-yellow	Yellow
AN–M54	Red-red	Green
AN–M55	Green-red	Green
AN–M56	Green-green	Red
AN–M57	Red-red	Red
AN–M58	Green-red	Red

Star Signal Mk 6

Length, inches	6.0
Diameter, inches	2.5
Weight, pounds	1.4
Burning time, seconds	25
Interval between launching and suspension, seconds	2.75

Use: Signals of this series are used primarily for emergency identification purposes at night.

Description: The body of the signal is an aluminum cylinder with a bouchon type of grenade-firing mechanism on one end and a metal cap on the other. Contained in the body are the ejection charge, the pyrotechnic candle, and a silk, rayon, or paper parachute. The type and color of the signal star are printed on the side of the cylinder. The closing cap on the lower end of the signal is embossed for night identification as follows: red star, one dot; white star, straight line; and green star a wide "V".

All three signals have an arc of a circle, one inch in length, embossed near the edge of the cap.

Operation: The signal is initiated in the manner prescribed for all bouchon-fuzed grenades. The 2.75-second delay, having been ignited by the primer, ignites the ejection charge. The ejection charge pushes off the closing cap, expelling the pyrotechnic candle and the parachute, at the same time igniting the starting mixture through a quick match. The parachute opens and suspends the candle, which burns for 25 seconds.

Smoke Signal Mk 7

Length, inches	10.0
Diameter, inches	2.5
Weight, pounds	2.5
Color	Red, Yellow, Green, or Black
Burning time, seconds	25

Use: This smoke signal is used for emergency identification in daylight.

Description: The Smoke Signal Mk 7 is the same as the Star Signal Mk 6, except for its length and the composition of the pyrotechnic candle. Also, the closing cap of the smoke signal is not embossed, but is painted the approximate color of the smoke produced.

Two-Star, Red, AN–M75

Length, inches	5.0
Diameter, inches	1.125
Altitude, feet	100—200
Burning time, seconds	6—8
Color	Red

Use: This distress signal is used as an emergency rescue signal.

Description: The signal is contained in a cylinder which houses the stars and the firing

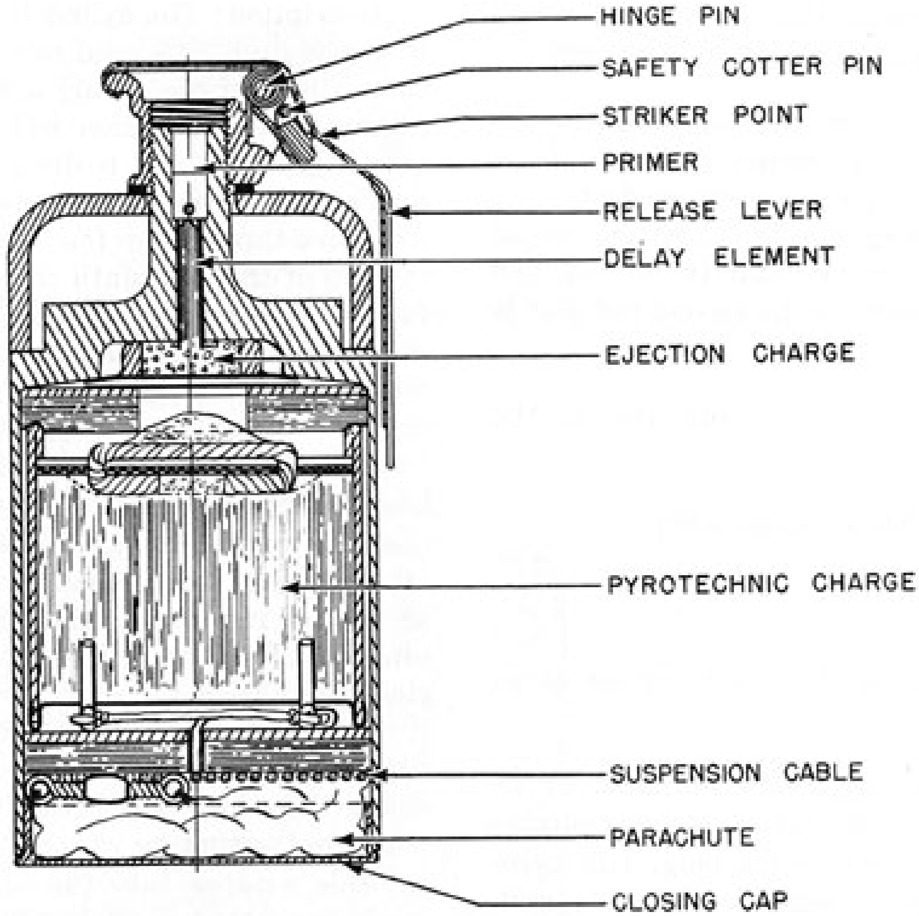


Figure 174. Aircraft Emergency Identification Star Signal Mk 6

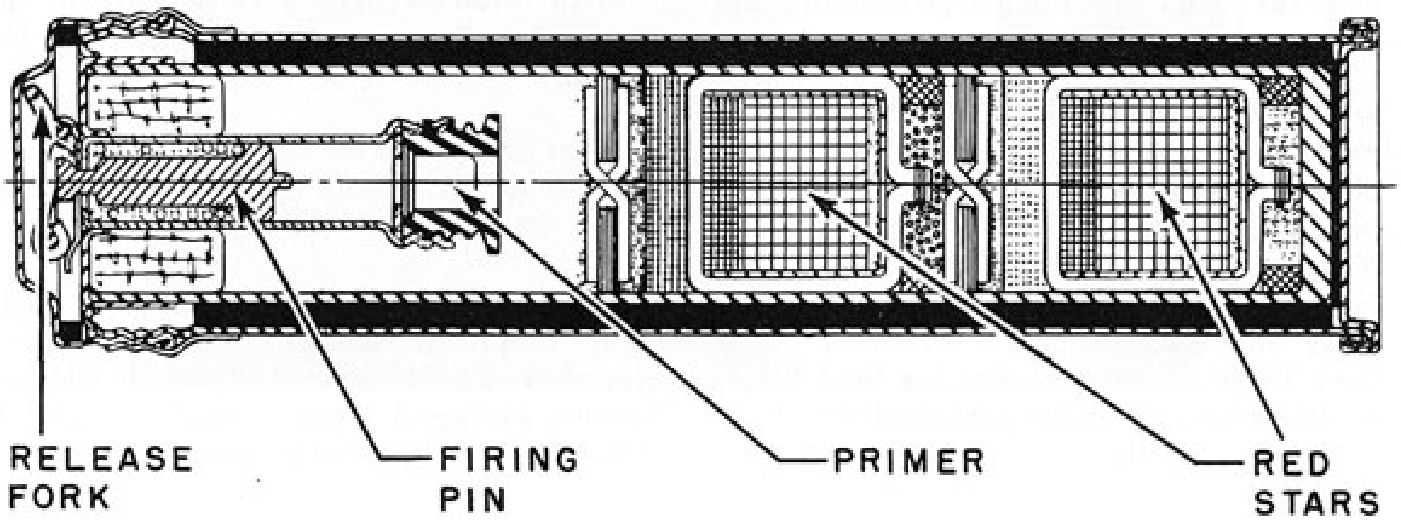


Figure 174A. Distress Signal, Two-Star, Red, AN–M75

mechanism. This mechanism consists of a pull release fork and a spring-loaded firing pin.

Operation: The tape is removed from the top cover and the cover is removed. The release fork is pulled; the firing pin is released and hits the primer, initiating the delay. After two to four seconds, the first red star is ejected, and after three to five seconds the second red star is ejected.

Remarks: This signal is not procured by the Navy.

Single-Star, Red, M73 (Obsolete)

Length, inches 2.25
Diameter, inches 1.0
Altitude, feet 200

Use: This signal was intended for use as an emergency signal.

Description: The signal is composed of an aluminum cylinder, one end of which contains a primer and the other a cork plug. The pyrotechnic composition is located below the cork plug.

Operation: The firing pin of the Pyrotechnic Discharger M10 strikes the primer, and the signal star is projected to the altitude of 200 feet.

Remarks: This signal is not procured by the Navy.

Smoke Grenades AN–M8, M16, M18, and AN–M4

Length, inches 5.7
Diameter, inches 2.57
Weight, pounds 1.68
Burning time, minutes........................3.5
Delay time, seconds 3

Use: These smoke grenades are used to attract attention to aviation personnel who have made a forced landing.

Description: The cylindrical sheet-metal case is nearly full of a solid smoke mixture. A circular zinc cup containing a starting mixture is located in a depression left in the top of the smoke mixture, and is designed to be initiated by a bouchon type of grenade-firing mechanism. Adhesive tape covers four quarter-inch holes in the top of the case until the signal is ready for firing. The grenade is painted gray and marked in yellow with one band, the symbol of the filler, "H.C.", and the word "smoke".

Operation: The release lever cotter pin having been removed, the release lever is freed by the operator as the grenade is thrown, and is forced off by the striker, which is at all times under tension of its spring. The striker moves on its hinge and fires the primer, which ignites a delay element that in turn ignites the starting mixture. The starting mixture burns through the zinc cup and starts a chemical reaction in the smoke mixture, generating considerable heat with the formation of zinc chloride. The zinc chloride escapes into the air as a gray-white smoke composed of finely divided solid particles. These particles are highly hygroscopic and become very obscuring liquid particles. The grenade burns for about three and a half minutes at full volume.

M-16 (obsolescent): Same as AN–M8—may have red, yellow, green, orange, violet, or black smoke.

M18: Same as M16, with burning reduced to one minute for a more dense smoke. Available colors are red, green, yellow, violet.

AN–M4: Has a shorter fuze lever and is issued in a metal container with three flaps designed to be bent outward to provide additional bearing surface for use in mud or snow. The AN–M4 is not procured by the Navy.

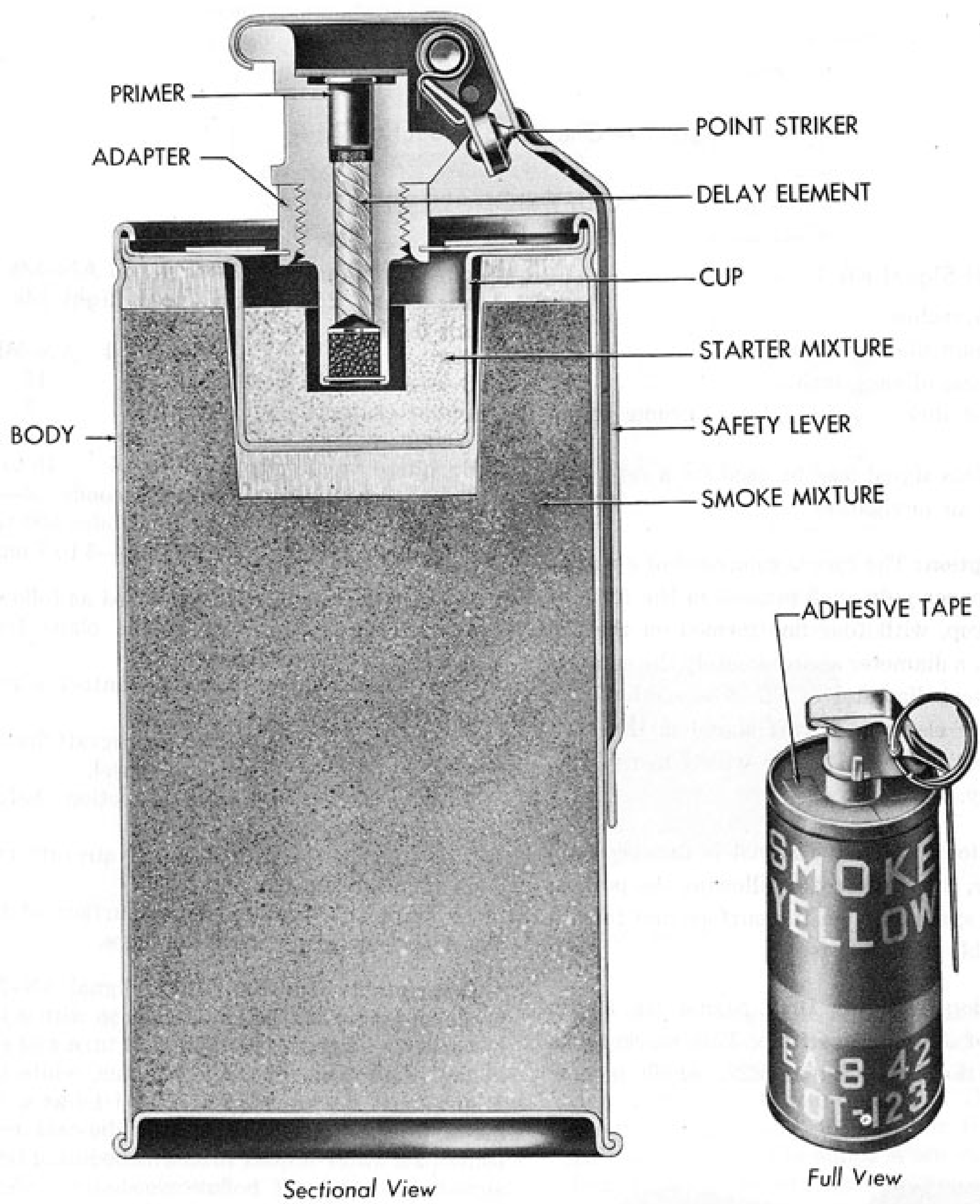


Figure 175. Smoke Grenades AN-M8 and M18

DRIFT SIGNALS

Day Drift Signal Mk 1

Length, inches	10.0
Maximum diameter, inches	3.5
Thickness of case, inch	0.07
Color of slick	Chrome yellow

Use: This signal may be used for a reference point for air navigation.

Description: The case is composed of a waterproofed paper pulp shell pressed in the form of a tear drop, with four fins formed on the tail cone with a diameter approximately the same as the greatest diameter of the nose section. The only other element of this signal is the very fine metallic powder filling which nearly fills the cavity.

Operation: When the signal is dropped into the water, the shell breaks, allowing the powder filling to spread out on the surface and form a slick visible to 15,000 feet.

Remarks: The Day Drift Signal Mk 1 is a Bureau of Aeronautics item. This marker has replaced the Drift Signal M25, which is now obsolete.

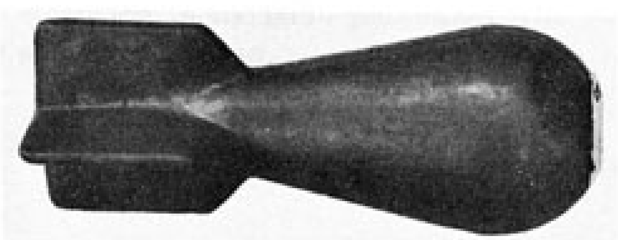


Figure 176. Day Drift Signal Mk 1

Night Drift Signals AN–Mk 4 and AN–Mk 5 Mods 1 and 2; Aircraft Float Light Mk 6 Mods 0—2

	AN–Mk 4	AN–Mk 5
Over-all length, inches	13	19
Diameter, inches	3	3
Weight, pounds	2	4
Burning time, minutes	3 to 3.5	15 to 17
Time from impact to ignition, seconds	8—12	
Release altitude	Under 500 feet	
Visibility	Night—6 to 7 miles	

Uses: These signals are employed as follows:

To determine the drift of the plane from which the signal was dropped.

To mark the initial point of contact with a submarine.

To mark an object to which an aircraft desires to call attention of a surface vessel.

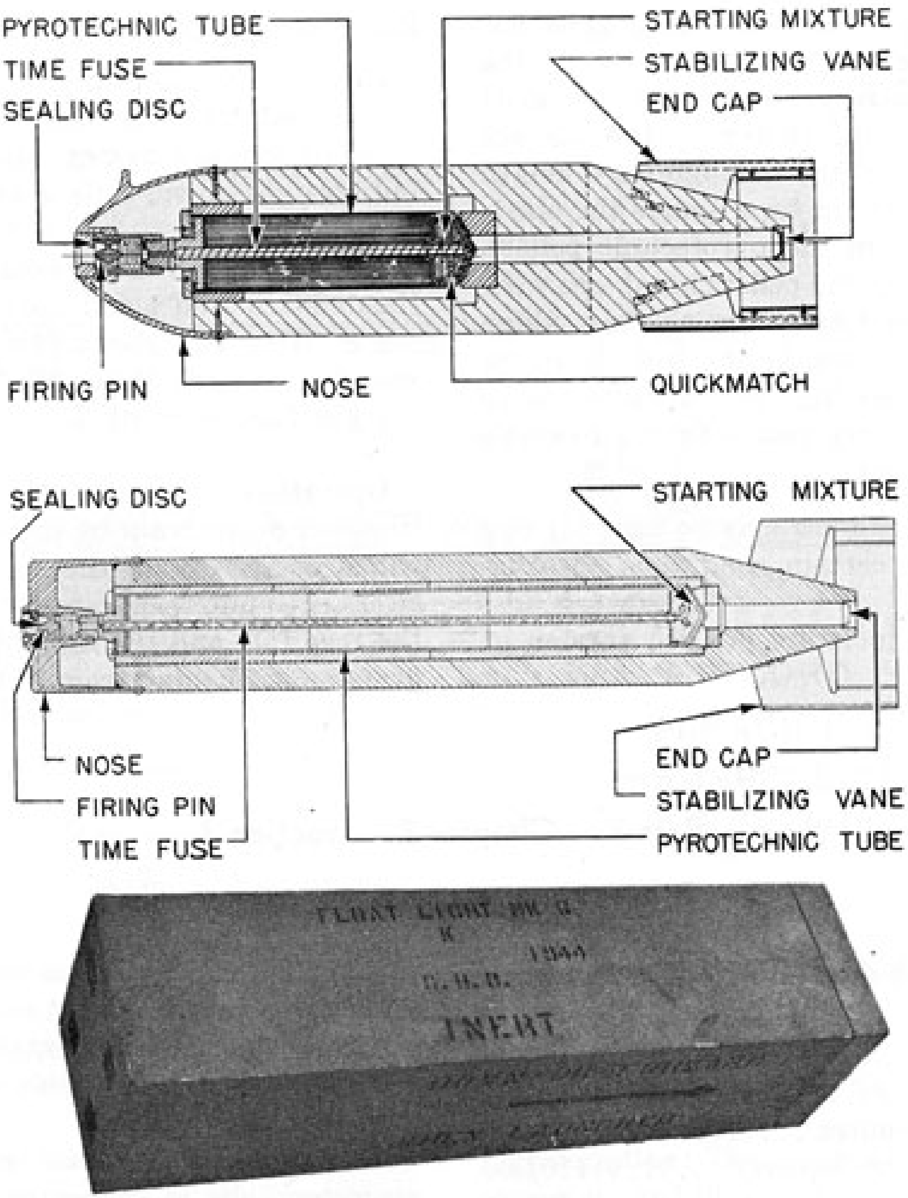
To determine the wind direction before landing.

To mark the landing deck on aircraft carriers for night landings.

To mark the location of the surface of the water for emergency night landings.

Description: The Night Drift Signal AN–Mk 4 has an ogival shaped, die-cast nose with a lug on one side so that the signal will turn and not strike the bottom in shallow water, while the Night Drift Signal AN–Mk 5 Mod 1 has a flat die-cast nose. In both cases the die-cast nose contains a water-impact fuze. The bodies of both signals are made of hollow wooden cylinders, with one end tapered, on which the tail assembly is mounted.

The pyrotechnic mixture is formed into pellets approximately four inches long and 1.25 inches in diameter, with a 0.022-inch hole concentric with the longitudinal axis through which the delay fuse passes. One pellet is used in the



100
AN Mk 4

Figure 177. Night Drift Signals

AN–Mk 4, and three pellets are used in the AN–Mk 5 Mod 1. The pellets are enclosed in a pyrotechnic tube to keep the hygroscopic material from absorbing moisture through the wooden body. Originally, pure tin was used for this purpose; but in recent lots lead and zinc have been substituted. The nose end of the signal is closed with a paraffin-treated sealing disc, while the tail is sealed with a metal cap.

Aircraft Float Light Mk 6 Mod 0 consists of four Drift Signals AN–Mk 5 Mod 1 which are contained in a square wooden body and burn successively. The box is 20.25 inches long and 5.125 inches square. The weight is 16 pounds, and the burning time is 45 minutes. The float light is released by hand from an altitude of from 300 to 5,000 feet. It gives off a grey smoke and a flame 10 or 12 inches high. The Aircraft Float Light AN–Mk 6 Mod 2 is ignited by a pull igniter which is pulled when released. The light can be dropped from an altitude over 5,000 feet.

Operation: When launched from aircraft, the drift signal falls nose-down. On impact with the surface of the water, the paraffined paper sealing disc is broken and the water drives the firing pin up against the primer. The flame from the

primer ignites the time fuse which runs the length of the hole through the center of the pyrotechnic pellets in order to give the drift signal enough time to return to the surface and right itself. The time fuse ignites a length of quick match which, in turn ignites the starting mixture and then the pyrotechnic pellets. The gases evolved by the pellets break open the pyrotechnic tube and force out the cap which seals the discharge tube in the tail. A bright flame 12 to 15 inches high and a white smoke are produced. These are visible for six to seven miles on a clear night.

Remarks: These signals may be used for day signals, but under certain conditions observation is difficult.

The Mod 2 is a moisture-proofed version of the Mod 1.

Retro-Rocket Drift Signals

General: These 3-inch rockets are designed to be fired aft from a plane to eliminate the effect of forward motion, allowing the signal to fall straight down. This is called retro-firing.

Description: The rockets have the 3-inch Heads Mk 5 Mod 1 and use the Motors Mk 2 or Mk 3. With the Motor Mk 2, they weigh 4.8 pounds; with the Motor Mk 3, 4.6 pounds. They use the Launcher Mk 2.

Operation: Firing of the rocket motor initiates a delay train in the signal in the head, which delay sets off the flare 10 to 20 seconds later. The motor separates from the head during the free fall, and the signal hits the water and floats on it, burning from 10 to 15 minutes.

Part 3 — Chapter 8 — Section 3

NAVY FLARES

1½ Minute Parachute Flare

Length, inches	18.75
Diameter, inches	2.44
Weight, pounds	4.31
Burning time, minutes	1.5
Light intensity, candlepower	110,000
Color	White
Maximum release altitude, feet	1,200
Rate of fall after ignition, ft./min.	550

Use: It is used to illuminate an area for emergency night landings by certain commercial-type aircraft in use by the Navy.

Description: The flare is issued in a hermetically sealed aluminum case called a projector tube. One end of this tube is closed by a metal cap and sealed by a gasket. The other end narrows down into a small knob with an electrical terminal in the extreme end. The tube is cylindrical for most of its length.

The projector tube contains an inner case and a propelling charge of black powder. The inner case contains an ejection charge, the pyrotechnic candle, and a parachute. The ejection charge is in the after end of the inner case, and the delay fuse and interrupter mechanism are mounted on the outside of the same end of the inner case.

The electrical terminal at the end of the projector tube is connected through a toggle switch in the pilot's compartment to the lighting system of the plane.

Releasing: The projector tube, which is constructed as an integral part of the flare, is fixed by clamp bands to a bracket in the after end of the fuselage, where the firing circuit is connected when the flares are loaded. The projector tube remains in the bracket when the flare is released or expelled by closing the switch in the cockpit.

Operation: When the electrical circuit is completed in the cockpit, the propelling charge is ignited and the inner case is forced out of the projector tube. The propellant ignites the delay fuse, which burns until the inner case is approximately 40 feet from the plane and then,

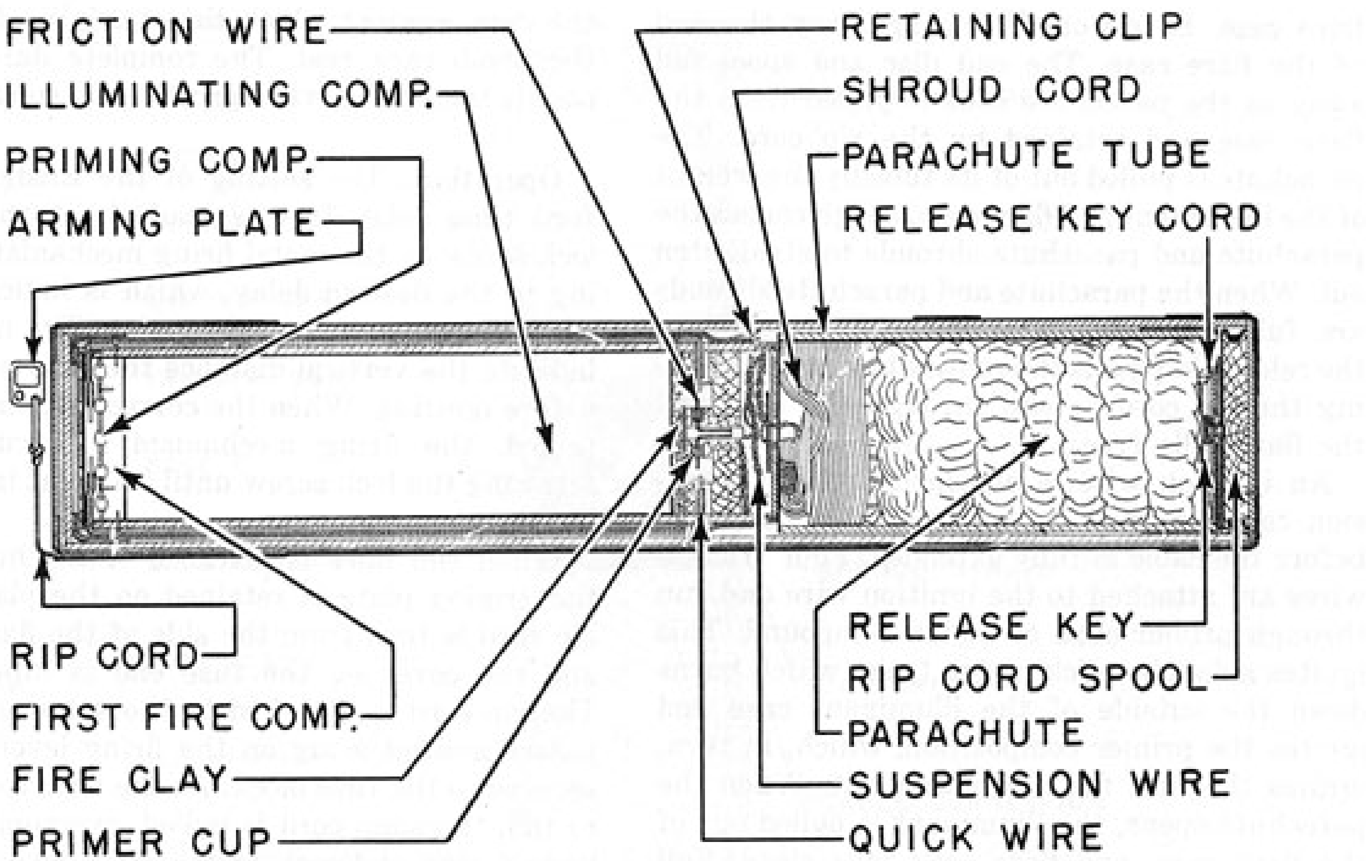


Figure 178. Flare Mk 4 Type

through an explosive lead-in, ignites the ejection charge which, in turn, forces the pyrotechnic candle and attached parachute from the inner case. Simultaneously, the ejection charge ignites the candle.

An interrupter mechanism between the delay fuse and the ejection charge in the inner case prevents the functioning of the flare until the inner case has left the projector tube and is clear of the plane.

Remarks: A proprietary item, this flare has a commercial designation of "1½ Minute Parachute Flare Mk 1 Mod 1", but this Mark designation is not that of the Navy.

Mk 4 and Mods

Length, inches	25
Diameter, inches	4.75
Weight, pounds	18
Burning time, minutes	3
Intensity, candlepower	300,000
Color	White
Releasing altitude, feet	1,200—5,000
Rate of fall after ignition, ft./min.	350

Use: Primarily, this flare is used to illuminate an area to permit the landing of aircraft. Occasionally, it is used for reconnoitering, bombing, and blinding antiaircraft defenses.

Description: The complete flare consists of a parachute and illuminant contained in a shellac-impregnated chip-board tube closed at the ends by chip-board discs which are held in place by gummed cloth and sealed with paraffin. There are two metal steadying bands fastened around the case, against which the steadying forks of the bomb rack rest. The complete flare is isued in a waterproof metal container.

Operation: The Navy Flare Mk 4 may be released from bomb racks or shackles, from an adapter, or manually. As the flare is dropped from the plane, the arming plate of the rip cord is retained by the plane and the rip cord is pulled from the side of the flare case to which it is fastened by gummed cloth tape. As the flare continues to fall, the rip cord, which is wound around a wooden spool inside the end of the

flare case, is unwound, tearing away the end of the flare case. The end disc and spool fall away as the parachute tube is pulled from the flare case and retained by the rip cord. The parachute is pulled out of its tube by the weight of the illuminant and flare case, which causes the parachute and parachute shrouds to straighten out. When the parachute and parachute shrouds are fully extended, a small cord attached to the release key pulls the release key down, allowing the rip cord to slip through the key, and the flare falls free.

An ignition wire is attached to the suspension cable in such a manner that it is pulled before the cable is fully extended. Four friction wires are attached to the ignition wire and run through primer cups of match compound. This ignites a double quick-match train, which burns down the outside of the illuminant case and ignites the primer composition, which, in turn, ignites the first fire and illuminant. When the parachute opens, the illuminant is pulled out of the flare case, and flare case falls clear. Full suspension and ignition occur about 30 to 50 feet below the plane.

Mk 5 and Mods

Length, inches	27
Diameter, inches	4.75
Weight, pounds	18
Burning time, minutes	3
Intensity, candlepower	750,000
Color	Mk 5 and Mk 5 Mods 1 and 2 are white; Mk 5 Mods 3—7, yellow
Release altitude, feet	3,500—15,000
Rate of fall after ignition, ft./min.	450

Use: The Navy Flare Mk 5 illuminates an area for reconnoitering, bombing, or landing.

Description: The complete flare consists of a parachute, an illuminant, and an impregnated chip-board case. It is closed on the parachute end by several layers of chip-board discs held in place by gummed cloth tape and sealed with paraffin, and on the fuze end, which contains the Ensign Bickford fuse, by a metal cover. There are two metal steadying bands fastened around the case, against which the steadying forks of the bomb rack rest. The complete flare in its case is issued in a waterproof metal container.

Operation: The setting of the Ensign Bickford time delay fuse is made by turning the lock screw on the metal firing mechanism housing to the desired delay, which is indicated on the bevel of the fuze-setting ring. The numbers indicate the vertical distance the fuze will drop before igniting. When the correct setting is obtained, the firing mechanism is secured by screwing the lock screw until its point is buried in the flare case.

When the flare is released from the plane, the arming plate is retained on the plane, the rip cord is torn from the side of the flare case, and the cover on the fuse end is flipped off. The rip cord is attached to the snap cord that passes around a lug on the firing lever and is secured to the fuse block. As the flare continues to fall, the snap cord is pulled, overcoming the lever spring and cocking the firing lever. When a tension of approximately 38 pounds is reached in the snap cord, it breaks, releasing the firing lever and the lever spring, then driving the firing lever back against the fulminate of mercury primer. The flare now falls free.

The primer ignites the black-powder pellets in the fuze plunger. The expanding gases from the burning black powder propel the sharp point of the plunger radially outward into the Ensign Bickford time fuse. There are three small holes near the point of the plunger which allows some of the flame to escape from the inside of the plunger into the powder of the Ensign Bickford fuse that causes its ignition. The time fuse burns its predetermined length at the rate of approximately 12 inches per 60 seconds, and ignites the quick match under the firing block.

The flash produced by the quick match ignites the firecracker fuse stapled to the ignition composition. The gases evolved when the ignition composition begins to burn force the end discs out at the parachute end, then expel the parachute and illuminant. The parachute tube, which is of split construction, falls away; the parachute opens; and the retention cable slides through the trigger snap on the end of the

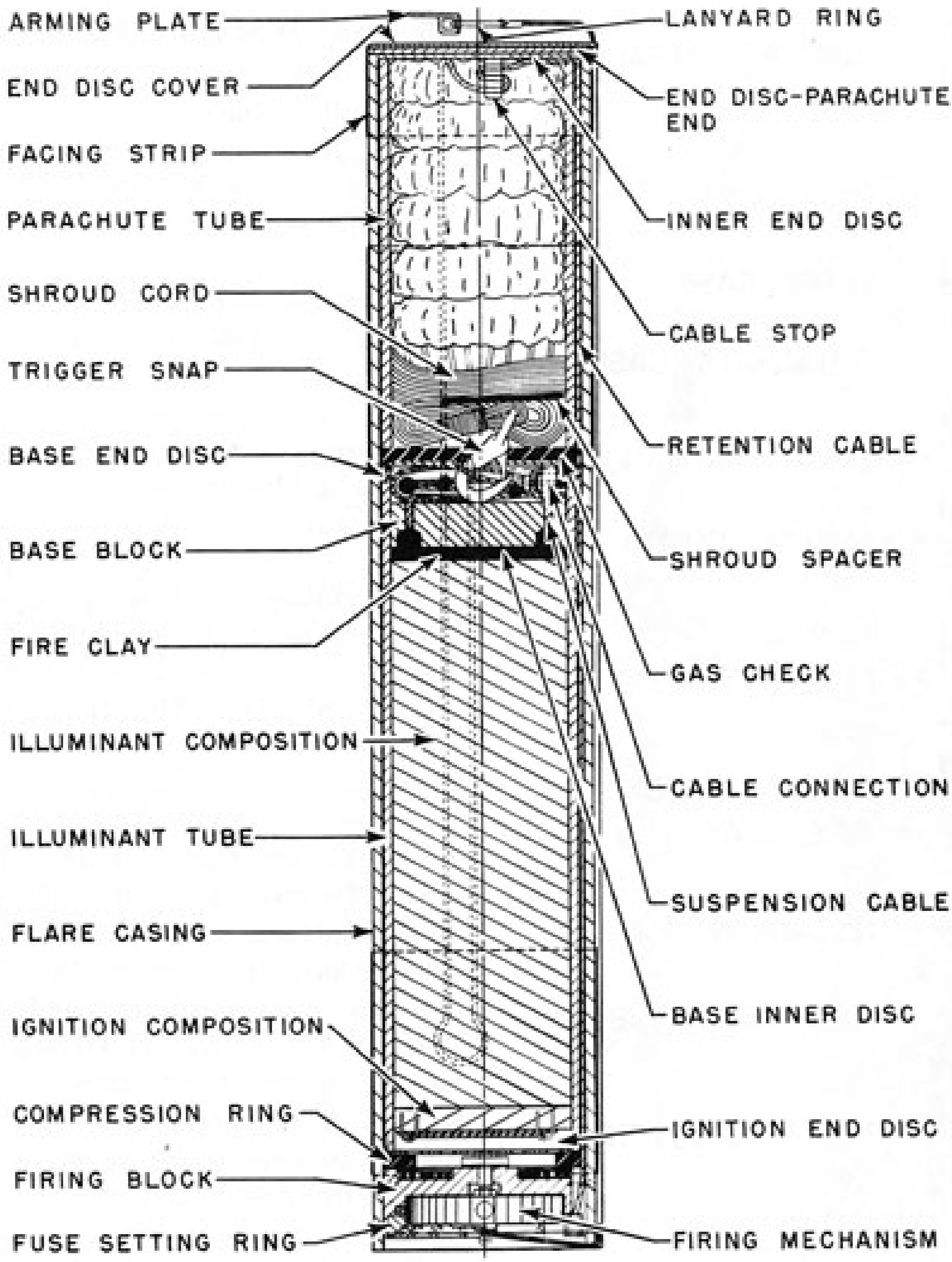


Figure 179. Flare Mk 5 Type

shroud lines until it reaches the cable stop. A short length of cable on one side of the cable stop suspends the flare case, and a longer length on the other side suspends the illuminant. This keeps the case from dropping as a missile hazard. The sudden shock caused by the contact of the cable stop with the trigger snap is taken up by a shock absorber. This is done by pulling a cable containing lead balls, called snubbers, through a hole which is of smaller diameter than the diameter of the snubbers. As each snubber passes through the hole, part of it is sheared off, thus absorbing part of the shock. The last ball is of much greater diameter and acts as a stop.

Remarks: In later models a new type of shock absorber eliminates the use of lead snubbers. The cable pulls through a connection in which friction absorbs the shock of the parachute opening.

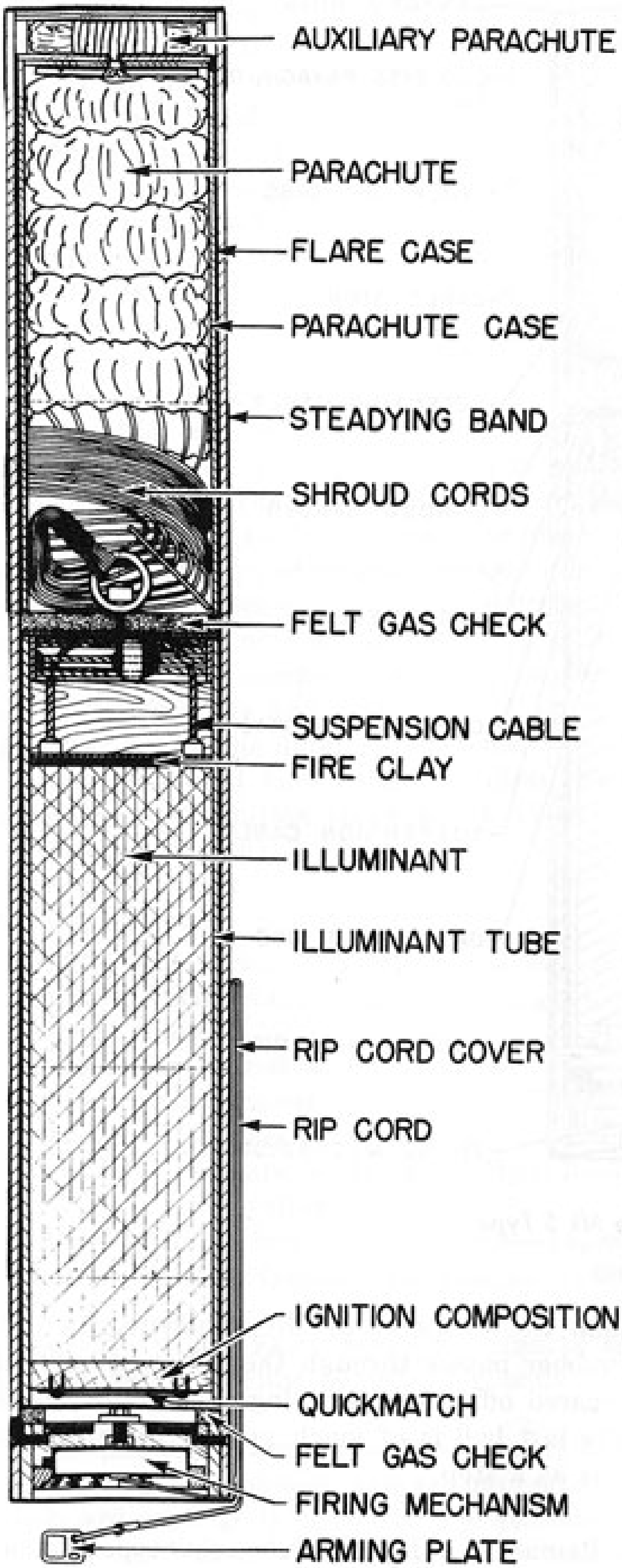


Figure 180. Flare Mk 6 Type

Mk 6 and Mods and AN–Mk 6 Mod 5

Length, inches	37.75
Diameter, inches	5.4
Weight, pounds	30
Burning time, minutes	3—3.5
Intensity, candlepower	1,000,000
Color	Yellow
Release altitude, feet	3,500—15,000
Rate of fall after ignition, ft./min.	450

Use: These flares are used to illuminate a large area for reconnoitering and bombing, and also as a blinding effect on the operators of antiaircraft weapons.

Description: The complete flare consists of the illuminant, a parachute, and an auxiliary parachute contained in a shellac-impregnated chip-board case. The case is closed on the parachute end by several layers of chip-board discs held in place by gummed cloth tape and sealed with paraffin, and on the illuminant end by an Ensign Bickford time fuse and a metal cover. To the snap cord of the Ensign Bickford fuse is attached the rip cord, which is taped down along the side of the flare case. There are two metal steadying bands around the case, against which the steadying forks or sway braces of the bomb racks rest. The flare is issued in a waterproof metal container, and should be kept there at all times when not installed in an aircraft.

Operation: When the flare is released, the arming plate is retained by the plane and the rip cord is torn from the side of the case, flipping the metal cover off the Ensign Bickford fuse. The operation of the fuse is the same as given in the Navy Flare Mk 5.

The gases evolved when the ignition composition begin to burn, force the end out of the flare case. Next, they expel the auxiliary parachute, the parachute in its case, and the illuminant. The flare case falls clear. The auxiliary parachute opens and retards the parachute in its case, to which it is attached, and the illuminant pulls the parachute out of its case. The auxiliary parachute and parachute case fall away, and the parachute opens.

Remarks: This flare also incorporates a shock absorber as used in the Navy Flare Mk 5, with either lead balls passing through a hole of smaller diameter than the lead balls, or a special connection utilizing friction to absorb shock of the parachute opening. *See Operation, p. 240.*

The Flare AN–Mk 6 Mod 5 differs from the Mk 6 and Mods in that the arming wire has swivel loops instead of an arming plate.

Flare Container Mk 1 Mod 0

Use: The Flare Container Mk 1 Mod 0 is an electrically operated jettisionable container for carrying six aircraft parachute flares of the Mark 6 type only, which may be released one at a time by electrical impulses from a 24-volt battery. The container may be suspended from any standard single or double-hook bomb rack.

Construction: It is necessary to cock the mechanism manually before the container can be loaded or unloaded. The container holds six flares, three on each side of the vertical panel, one above the other. The dividing panel assembly supports the flares by metal arms or chocks. The flares are loaded with the fuze end aft, and the end of the lanyard is secured to the container. The energy for the operation of the container is stored in torsional springs and released by a solenoid. By wiring in series, several containers can be operated to secure an uninterhupted release of a series of more than six flares.

Operation: When the solenoid is energized, the spring-loaded plunger, which is linked mechanically to the release rack, retracts completely, thereby effecting the release of one flare. The solenoid plunger will remain retracted so long as the current is on. To release another flare, the circuit must be broken long enough to allow the spring-loaded plunger to return to the normal position before applying the next impulse. The maximum rate of release is about 10 flares per second, which is the highest rate practicable in order to prevent interference between the individual flares.

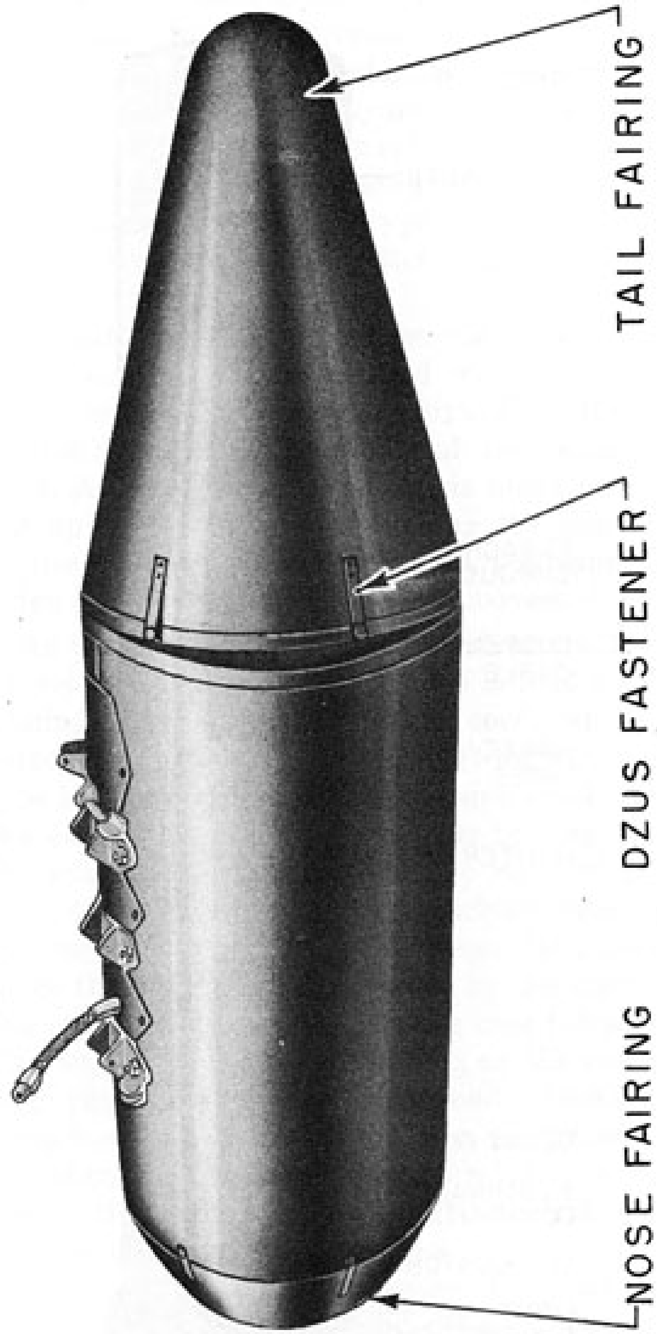


Figure 181. Flare Container Mk 1 Mod 0

The cocking lever should always be in the "safety" position when on the ground, and only switched over to the "operational" position before the plane takes off. Correctly loaded flares are a fire hazard, since they are always armed.

Remarks: When the container is used in a bomb bay, it is intended that it be used without the nose and tail fairings. If desirable, the spring doors may also be removed.

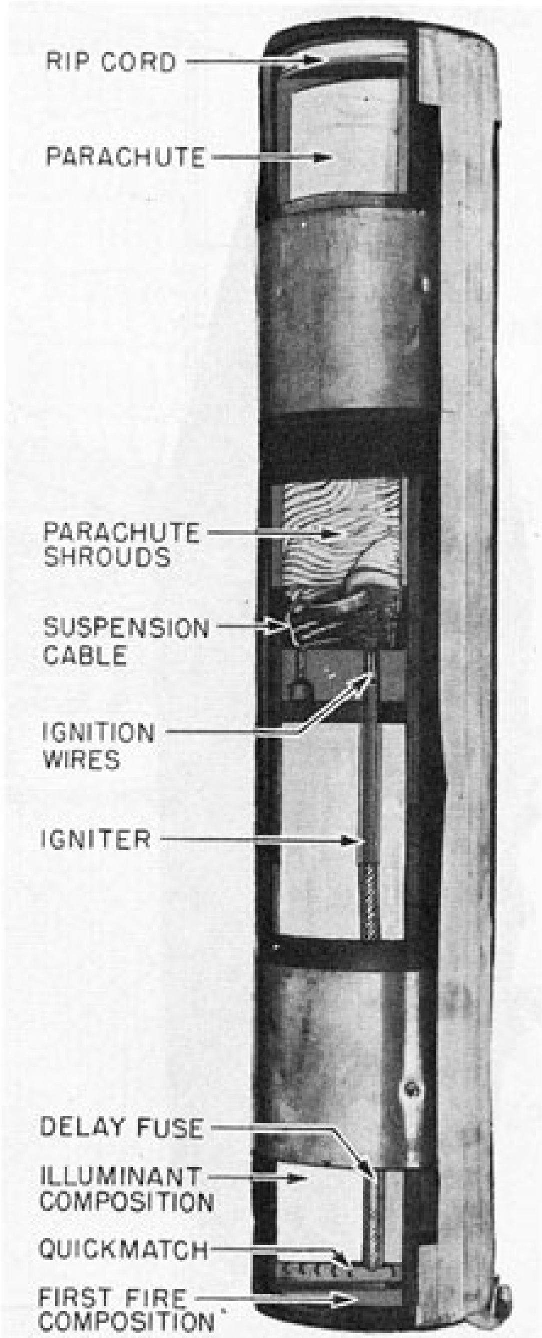


Figure 182. Flare AN–Mk 8 Type

AN–Mk 8 and Mods

Length, inches	25.0
Diameter, inches	4.75
Weight, pounds	16.0
Burning time, minutes	3—3.5
Color	Yellow (pale)
Intensity, candlepower	600,000
Minimum release altitude, feet	2,500
Rate of fall after ignition, ft./min.	500

Use: This flare was developed specifically for night antisubmarine warfare.

Description: This flare is the same as the Navy Flare Mk 4, except that the over-all length is two inches shorter and the illuminant in the Mod 0 and Mod 1 has a 90-second delay fuse through its center or a 120-second delay fuse in the Mod 2.

Operation: This flare is similar to the Navy Flare Mk 4, except that, when the ignition wire attached to the suspension cable is pulled, it pulls the friction wires in the Ensign Bickford fuse igniter, igniting the delay fuse running through the center of the illuminant. When the parachute opens, the illuminant is pulled out of the flare case, and the flare case falls away. The sudden shock caused by the opening of the parachute is taken up by a shock absorber of the solder balls and aperture type employed on the Flare Mk 4. Full suspension of the flare occurs approximately 30 to 50 feet below the plane, and 90 or 120 seconds later the first fire of the illuminant is ignited by the delay.

Remarks: The Flare Mk 8 Mod 1 and Mod 2 can be launched at speeds up to 220 knots, but the Flare Mk 8, which does not have the snubbers for the shock-absorber effect, should not be launched at speeds greater than 150 knots.

Mk 10 Mod 0

Length, inches	37.75
Diameter, inches	5.4
Weight, pounds	30
Burning time, minutes	4.5
Intensity, candlepower	750,000
Color	Pale yellow
Release altitude, feet	3,500—15,000
Rate of fall after ignition, ft./min.	450

Use: This flare is employed to illuminate an area for reconnoitering, bombing, or landing.

Description: The Navy Flare Mk 10 Mod 0 has the same dimensions as the Mk 6 and Mods. The internal construction is similar to the Mk 5 and Mods, except that the Mk 10 Mod 0 has a

metal suspension cup to which the suspension cable and pyrotechnic candle are fastened, and the Mk 5 and Mods has a wooden suspension-base block.

Operation: The operation is similar to that of Navy Flare Mk 5 and Mods.

Remarks: Though this flare has a specified light intensity of 750,000 candlepower, tests have shown that it has a light intensity of 800,000 to 850,000 candlepower. In the future it may be manufactured so as to have a light intensity of approximately 1,000,000 candlepower.

Mk 11 Mod 0

Length, inches	37.75
Diameter, inches	5.37
Weight, pounds	30
Burning time, minutes	3
Color	Pale yellow
Intensity, candlepower	1,000,000
Delay, seconds	90—180
Minimum release altitude, feet	2,500—4,000

Use: The Navy Flare Mk 11 will supplement the AN–Mk 8 for night antisubmarine warfare.

Description: The shellac-impregnated chipboard case of this flare has two metal steadying bands fastened to it and is closed at the parachute end by a chip-board disc held in place by a gummed cloth and sealed with paraffin. The rip cord is wound around a spool at the parachute end of the flare, and is attached to the parachute tube through a release key. The parachute and parachute shrouds are enclosed in the parachute tube. The shrouds are attached to a suspension cable, which is attached to the illuminant assembly.

The fuze end of the flare is closed by a metal fuze and a cover which must be removed when setting the fuze. Immediately below the cover is a firing lanyard with a swivel loop on one end and a clip-type loop on the other.

The selective-delay ignition device is similar to the fuze used in the Mark 5 and Mark 6 types of aircraft parachute flares, the chief difference being that the fuze is initiated by a pull cord running through the center of the illuminant instead of by a firing lanyard. The pull cord is attached to the suspension cable. A safety screw keeps the firing lever of the fuze in position during shipping. A friction-type snubber is employed at the lower end of the suspension cable.

Operation: The metal fuze-end cover is removed and the firing lanyard withdrawn. The clip-type loop or the metal lanyard is attached to the arming wire retainer of the launching gear. A selective delay setting is made by pulling up on the index pin, turning the indicator to the required delay, and then releasing the index pin. The safety screw is removed.

As the flare falls away from the aircraft, the swivel loop of the firing lanyard is held by the arming-wire retainer. The rip cord, which is fastened to the metal lanyard through the clip-type loop, unwinds from the wooden spool inside the end of the flare casing, thus tearing away the end of the flare casing. The rip cord then pulls out the spool and the parachute tube containing the parachute. The spool falls away. Since the parachute tube is held by the rip cord, the pyrotechnic candle and flare case fall away. The weight of the candle pulling on the suspension cable and parachute shrouds draws the parachute out of the tube. When the parachute and shroud lines are fully extended, the release-key cord becomes taut and pulls one end of the release key down. This allows the rip cord to pull through the key and become detached from the parachute and the tube, which falls clear. The rip cord and metal lanyard are retained by the aircraft. The parachute opens and suspends the flare 30 to 50 feet below the aircraft. The parachute pulls the candle out of the flare case, which falls free.

The selective-delay ignition device functions in a manner similar to the fuze used in the Flares Mk 5 and Mk 6. The fuze is initiated by a wire pull cord which passes through a hole through the center of the candle. The pull cord is attached to the suspension cable in such a manner that it is pulled away from the primer and then released, striking the primer and

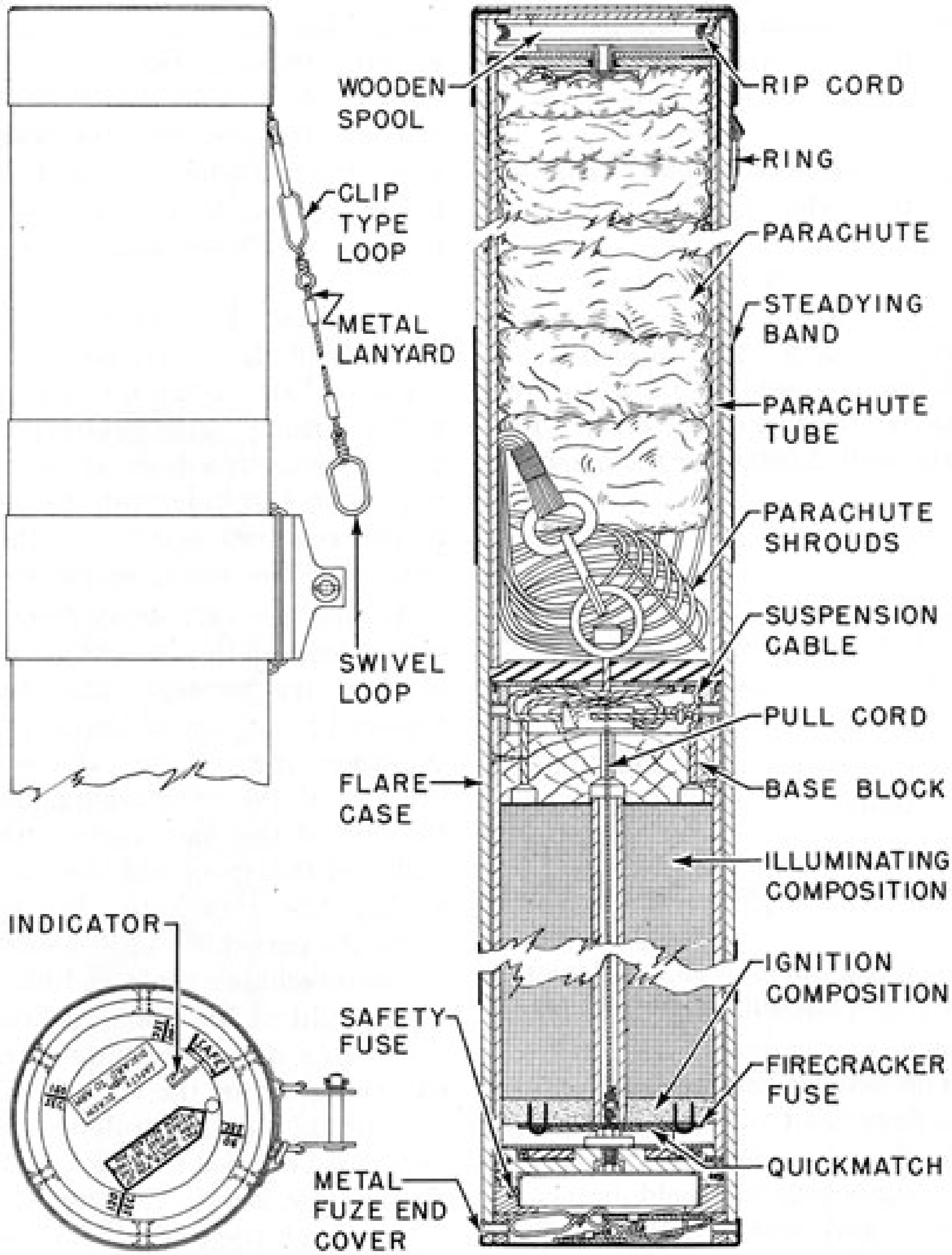


Figure 183. Flare Mk 11 Mod 0

igniting the powder pellets in the fuze plunger. The burning powder forces the pointed end of the plunger into the Bickford Fuse which is ignited by flame through holes in the plunger. The time fuse ignites the quick match under the fuze block, which in turn ignites the quick match and firecracker fuse stapled to the ignition composition. The ignition composition ignites the candle. The gases generated by the burning candle blow the fuze assembly off from the end of the pyrotechnic candle, and the fuze falls clear.

Remarks: This flare differs from the AN–Mk 8 and Mods in that there is a selective delay between the opening of the parachute and ignition of the pyrotechnic candle. The selective delay allows a single patrol plane to drop a flare near the target and then get into position for the attack before the flare discloses his position.

Float Flare Mk 17 Mod 0 and Mod 1

Length, inches 60.75
Diameter, inches. 9.5
Weight, pounds. 88.0
Color . . . . Yellowish white
Intensity, candlepower. 1,000,000
Burning time, minutes. . . . . 4.5—5
Delay, minutes . . . . Mod 0—1
Mod 1—5.5

Use: This flare is used to illuminate enemy surface craft.

Description: The flare case is a cylindrical body of sheet metal tapered at one end from 9½ inches to approximately 4 inches, which section has a lead weight and four membrane-covered ports approximately two inches in diameter. The after end of the flare case is closed by a canvas bag containing a parachute. The candle is in a central tube so mounted as to keep the burning mixture at the top of the flare by spring action.

Operation: When the flare is removed from the box, the adhesive tape on the cover is pulled off and membranes covering the ports in the nose are punctured. The flare is loaded into the bomb rack with the pointed end of the flare toward the forward end of the plane. Sufficient static line is pulled from the pocket in the parachute canvas bag to allow the ring attached to the end of the line to be secured to the arming-wire retainer on the rack or shackle. On launching, a combination-type fuze causes a delay before the pyrotechnic candle burns.

Remarks: Flares having a one-minute delay setting may be released at elevations between 100 and 4,000 feet; 5½-minute delays may be released from greater altitudes. Descent is at a rate of between 80 and 100 feet per minute.

A continuous illumination of nine minutes' duration may be obtained by dropping a Mod 0 and a Mod 1 together.

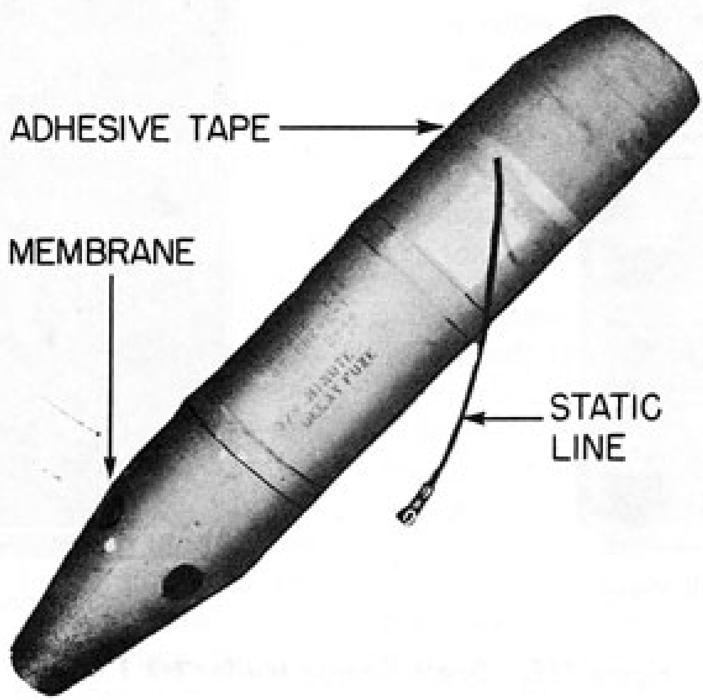
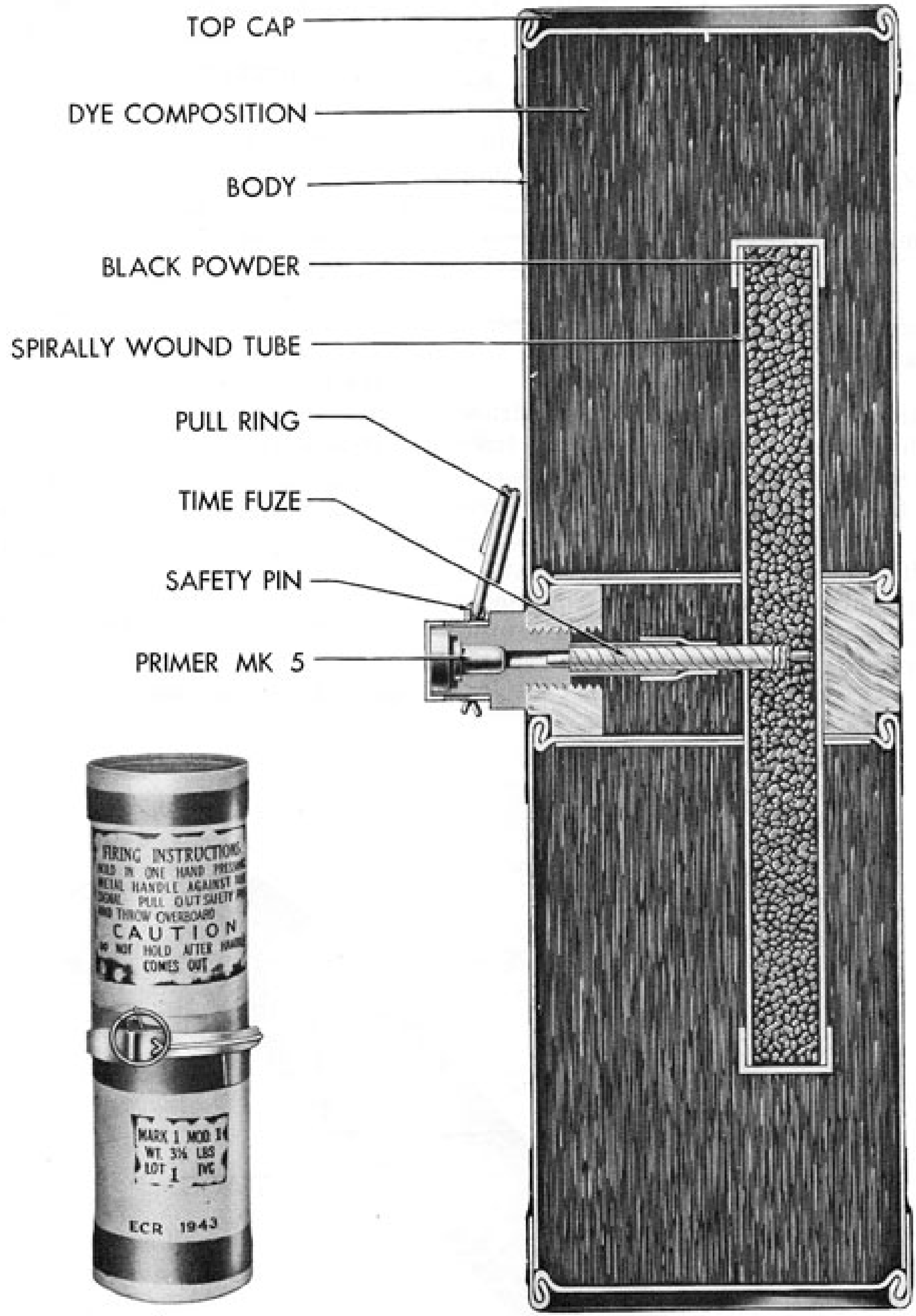


Figure 184. Float Flare Mk 17 Type



Full View *Sectional View*

Figure 185. Depth Charge Marker Mk 1 Mod 1

DEPTH CHARGE AND SLICK MARKERS

Day Depth Charge Marker Mk I Mods I and 2

Over-all length, inches 11.88
Diameter, inches 3.46
Weight, pounds 3.5
Weight of dye, pounds 2.75
Weight of bursting charge, grams 30
Effective releasing altitude . . . . . Up to 1,000′
Visibility . . . . . . 3,000 yards from deck of ship
5 miles from aircraft

Use: The marker is used to indicate the initial point of contact with submarines and provide a reference point for further search and attack during day operation.

Description: The marker consists of a circular wooden block on which is mounted a grenade-firing mechanism with a 15-second delay. Fluorescein dye is contained in two cylindrical paper cans, one attached to each flat side of the wooden block; and a celluloid tube containing the black-powder bursting charge is attached to the delay element and extends through the wooden block into the paper cans. The dye is rusty red in color when dry, but a water solution of the dye is yellow-green.

Operation: The operator clasps the marker firmly in one hand, being sure that the release lever is held against the body of the marker. With the other hand, he pulls the safety ring which is attached to the safety cotter pin and launches the marker by throwing it over the side. When the marker is released, the spring-loaded striker forces the release lever off. The striker, rotating about a hinge pin, hits the primer that ignites the 15-second delay fuse. The delay gives the marker sufficient time to reach the water and float on the surface, and then ignites the bursting charge. The gases evolved from the charge burst the dye containers and spread the dye on the water, forming a yellow-green slick about 40 feet in diameter. The slick lasts for 45 to 60 minutes.

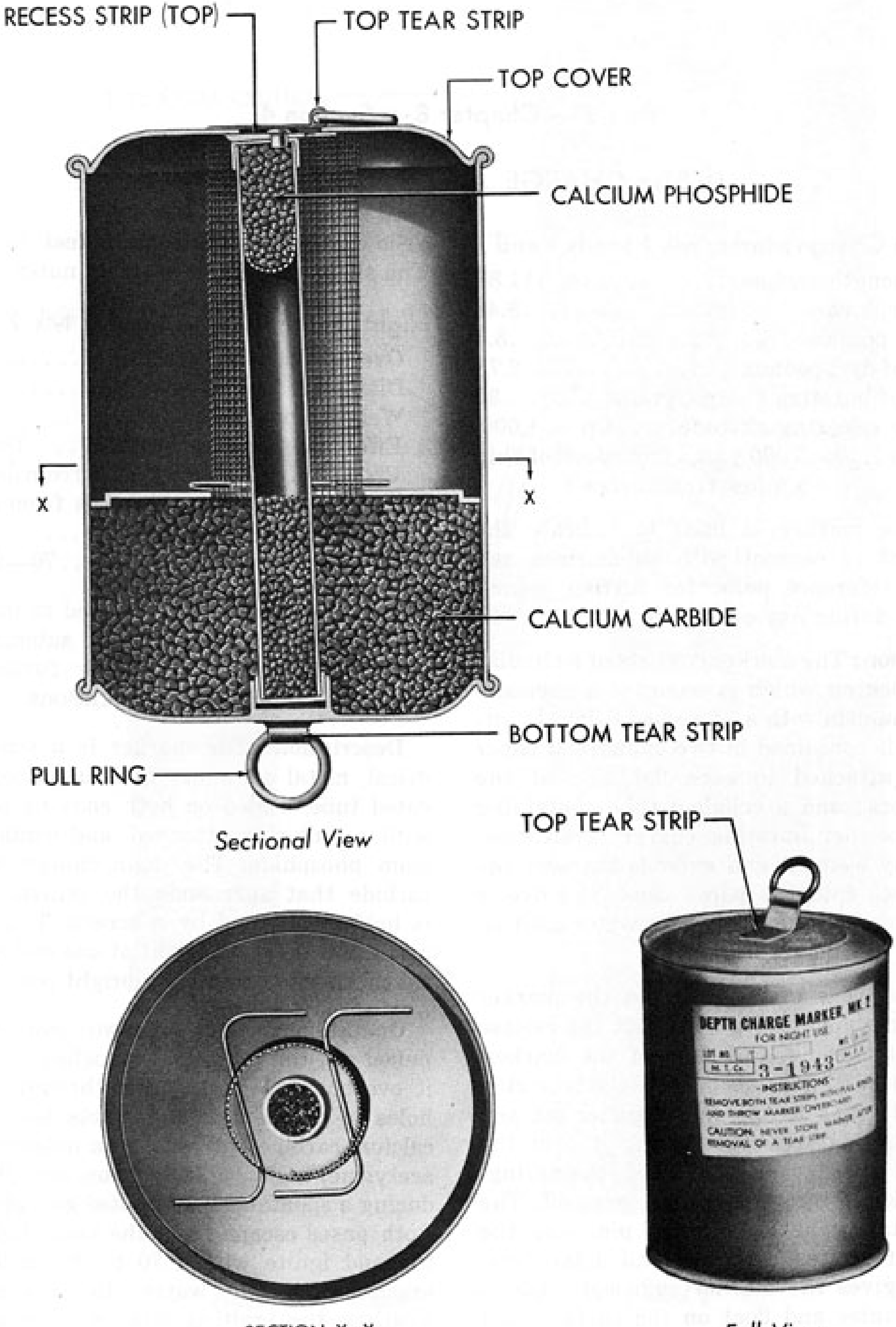
Night Depth Charge Marker Mk 2

Over-all length, inches 7
Diameter, inches 5
Weight, pounds 2.5
Effective releasing altitude . . . . . Up to 3,000′
Visibility . . . . 4 miles from deck of ship
10 miles from aircraft
Burning time, minutes 55
Ignition time (after impact) . . 70—90 seconds

Use: The marker is employed to indicate the initial point of contact with submarines and provide a reference point for further search and attack during night operations.

Description: The marker is a sealed, cylindrical, metal container that has a centrally located tube, sealed on both ends by tear strips with a pull ring attached, and containing calcium phosphide. The main charge is calcium carbide that surrounds the central tube and is held in one end by a screen. This produces a concentration of weight at one end and allows the marker to float in an upright position.

Operation: After the two tear strips are pulled off, the marker is launched by throwing it overboard. Water enters through the small holes in the bottom and reacts both with the calcium carbide (producing an inflammable gas, acetylene) and with the calcium phosphide (producing a spontaneously ignited gas, phosphine). Both gases escape from the small holes in the top and ignite within 70 to 90 seconds after impact with the water. In extremely cold weather, the ignition delay may be somewhat longer. The resulting flame is about nine inches high. If it should be put out by rough water, the gases will ignite again.



Sectional View

SECTION X-X

Full View

Figure 186. Depth Charge Marker Mk 2

Slick Marker Cartridge AN–Mk I

Length, inches	3.8
Diameter, inches	1.5
Muzzle velocity, ft./sec.	300
Weight of dye, grams	28

Use: This marker is used primarily to provide reference points for aircraft engaged in antisubmarine warfare.

Description: The cartridge is composed of a shotgun-type case containing a primer, a black-powder propelling charge, and the projectile. The projectile has a thin aluminum case and contains 28 grams of fluorescein dye and a black-powder bursting charge initiated by a Bickford type fuse.

Launching: The marker cartridge is fired in the Pyrotechnic Pistol AN–M8, which may be held in the hand or mounted in the Mount M1.

Operation: When the cartridge is fired, the black powder in the head of the case propels the projectile from the pistol and at the same time ignites the Bickford fuse. The fuse burns for about eleven seconds before igniting the bursting charge which expels the fluorescein dye out into the water. The projectile has a positive buoyancy and will remain near or at the surface until a small, bright green slick is created.

Remarks: This cartridge should not be fired from altitudes greater than 500 feet, because the cartridge must be in the water when it bursts.

Slick Marker AN–M59

Length, inches	10.875
Diameter, inches	3.375
Weight, pounds	2.9

Use: This is the standard all-purpose sea marker for daylight use: to provide reference points; to aid in determining drift; and to provide practice bombing targets on water.

Description: This marker consists of a paper composition case filled with a fluorescein dye. It is protected by a cylinder of papier-mâché, which does not interfere with its function.

Launching: The marker is dropped by hand from a plane.

Operation: Upon impact with water, the case shatters and the dye spreads upon the surface.

Part 3 — Chapter 8 — Section 5

ARMY FLARES

M8 and M8A1

Length, inches	25.5
Diameter, inches	4.25
Weight, pounds	18.0
Intensity, candlepower	350,000
Color	Yellow
Burning time, minutes	3
Rate of fall after ignition	500 ft./min.

Use: The flares are used in emergency night landings.

Description: Each flare consists of a cylinder containing an unshaded candle.

Operation: Army Flares M8 and M8A1 are similar in operation to the Flares AN–M26, except that the hang wire pulls the parachute directly from the case.

Remarks: The M8 is similar ot the M8A1, except that the latter flare burns with a white light of approximately 250,000 candlepower.

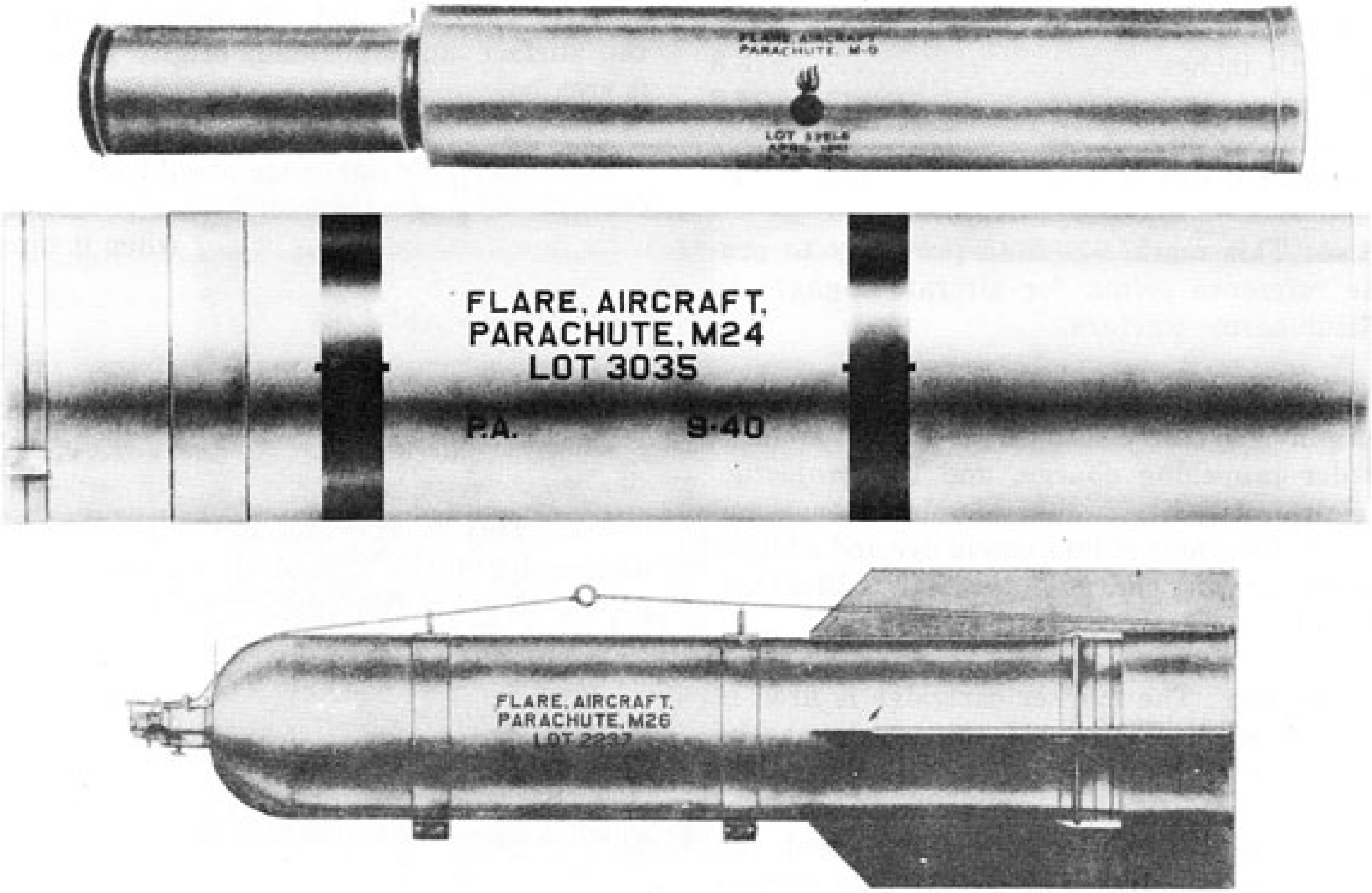


Figure 187. Army Flares M9 (top), M24 (middle), and M26 (bottom)

M9 and M9A1

	M9	M9A1
Length, inches	13.8	15.05
Diameter, inches	2.0	—
Weight, pounds	1.9	2.1
Intensity, candlepower	60,000	—
Color	Yellow	—
Burning time	1 minute	—
Rate of fall after ignition	400 ft./min.	400 ft./min.

Use: This flare was designed to satisfy the requirements for a small parachute flare for reconnaissance.

Description: The flare consists of a cylinder containing a candle, designed to be projected with the Pyrotechnic Pistol AN–M8.

Operation: The flare is discharged from the pistol and the delay fuse is ignited. The fuse burns for 2.5 seconds and ignites the expelling charge, which expels the candle and parachute, simultaneously igniting the candle.

Remarks: This flare is not procured by the Navy.

M24 (Obsolete)

Length, inches	37.0
Diameter, inches	8.0
Weight, pounds	47.0
Burning time, minutes	3
Intensity, candlepower	800,000
Color	Yellow
Release altitude, feet	2,500—3,000
Speed of release	Not over 200 m.p.h.
Rate of fall after ignition, ft./min.	700

Use: The flare is a substitute standard for night observation and bombardment.

Description: It consists of a simple cylinder without hemispherical nose or tail fins; other-

wise, it is similar throughout to the AN–M26, without the nose time fuze.

Operation: The flare is similar to the AN–M26 except that the hang wire acts directly to pull the parachute from the flare case.

Remarks: This flare was not procured by the Navy.

M26 and AN–M26

Length, inches	50
Diameter, inches	8
Weight, pounds	53
Burning time, minutes	3—3.5
Intensity, candlepower	800,000
Color	White light
Releasing altitude, feet	4,000—25,000
Rate of fall after ignition, ft./min.	700

Use: These flares are used to provide illumination for night bombardment; also may be used to blind antiaircraft defenses.

Fuzing: AN–M146, M155, M144.

Description: The flare is enclosed in a metal cylindrical case with a rounded nose and tail fins. In the nose is a mechanical time fuze. The tail end is closed with a shipping cover that has a handle attached and sealed by a strip of tape. The case is equipped with two suspension lugs 14 inches apart.

Operation: When the flare is dropped, the arming wire is pulled, allowing the vanes of the nose fuze to rotate. The hang wire is retained and pulls off the cover of the stabilizing-sleeve compartment. As the flare continues to drop, the tear wire and tear-wire cord pull out the stabilizing sleeve, and the cover-lock cord attached to the shrouds of the stabilizing sleeve unlocks and pulls out the cover lock. When the sleeve is fully extended, the tear wire breaks, allowing the flare to fall free, stabilized in flight by its fins and stabilizing sleeve.

When the nose fuze functions, the gases of the black-powder booster force the releasing-cup cover out of the detachable cover, releasing the retaining pins from the groove in the flare case and freeing the detachable cover. As the detachable cover is pulled out by the stabilizing sleeve, a pull-out cord pulls out the parachute. When the parachute opens, the flare stops with a jerk, breaking the pull-out cord (which allows the stabilizing sleeve assembly to fall free) and pulling the entire flare assembly out of the flare case (which then falls away). The sudden stop also pulls the friction wires through the igniters, starting the six-second delay through the center of the candle, which allows full opening of the parachute.

The shock caused by the opening of the parachute is taken by the shock absorbers, made of copper tubing in a spiral or coiled shape. They straighten out in absorbing the shock. After the parachute is opened, the delay ignites the first fire, which ignites the candle. When the first fire is ignited, the gases formed by burning force the rib retainer down, and the spring-loaded ribs jump out, opening the glass-cloth shade.

Remarks: The Flare AN–M26 can be dropped at air speeds up to 240 knots, but above that the stabilizing sleeve is apt to tear away. The Flare M26 cannot be dropped at air speeds greater than 130 knots, for the same reason.

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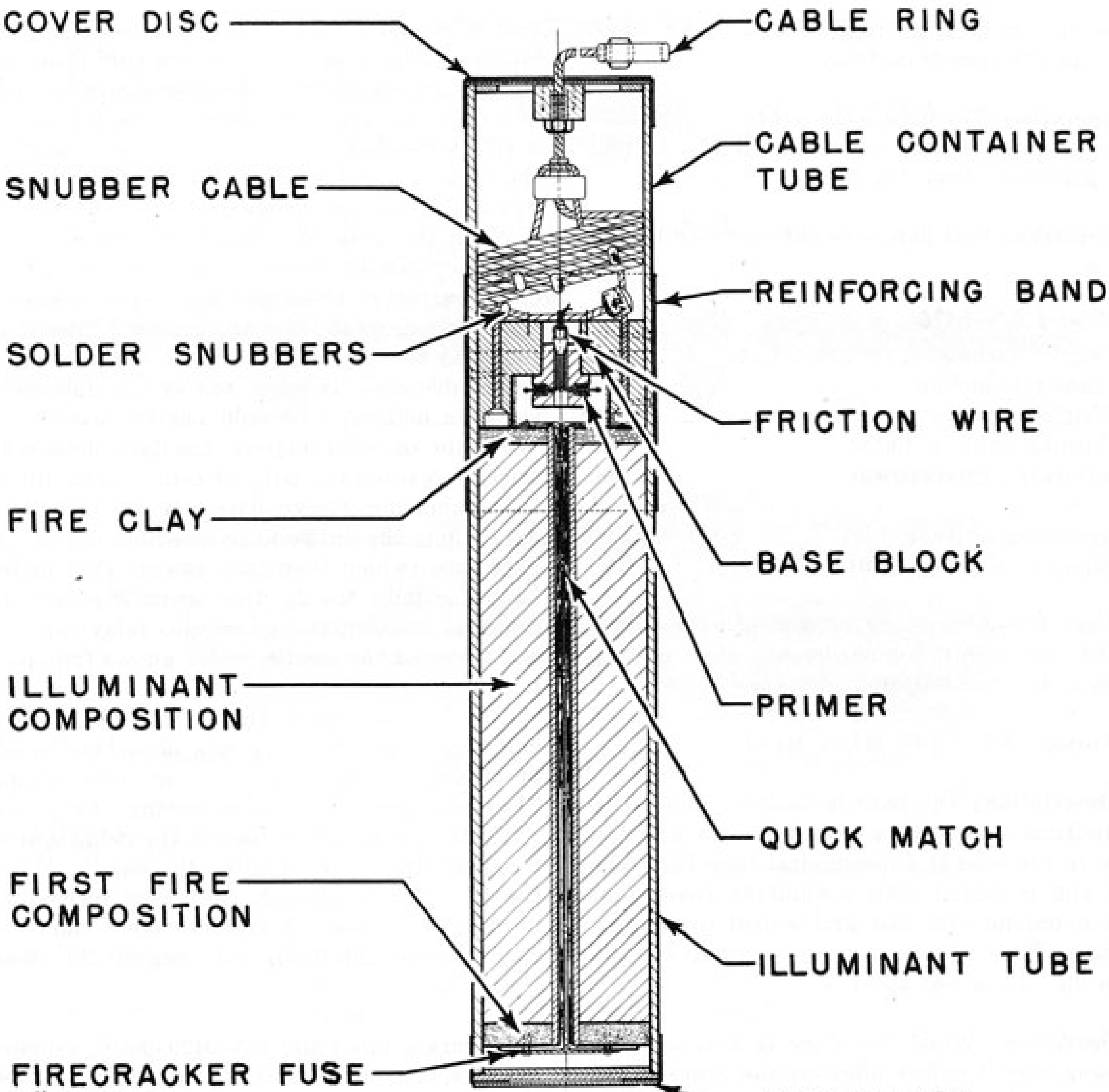


Figure 188. A.A. Target Flare Mk 1

A.A. TARGET FLARES

Mk I (Obsolete)

Length, inches	21.4
Diameter, inches	3.8
Weight, pounds	12
Burning time, minutes	3
Intensity, candlepower	280,000

Use: The flare provides a target for both day and night practice firing of antiaircraft guns.

Description: The flare consists of an illuminant tube and a cable-container tube made of rocket paper. These are joined end-to-end under the external metal reinforcing band. Both ends are closed by chip-board discs held in place with tape. The cable ring is attached to the snubber cable at the end which protrudes through the cover disc of the flare assembly. The snubber cable is attached to the base block with staples.

Friction wire is attached to the end of the snubber cable and extends through the primer composition, which is adjacent to the quick match which runs through a cardboard tube in the center of the illuminant. At the end of the quick-match tube is a firecracker fuse terminating in the first fire composition, which is in contact with the main illuminant charge.

Streaming: The flare may be streamed from any plane from which an aircraft or antiaircraft target reel can be mounted.

Operation: The flare slides back along the tow cable until the cable ring is stopped by the target release mechanism. Force exerted on the snubber cable pulls off the end of the cable-container tube, and the five solder snubbers are stripped off. The staples holding the snubber block to the base block are withdrawn by the pull exerted. Friction wire attached to the end of the snubber block is pulled through the primer. The flame from the primer ignites the quick match, which in turn ignites the firecracker fuse igniting the first fire charge. The first fire composition ignites the illuminant.

M50, M77, M78, and M79

	M50	M77	M78	M79
Length, inches	22.8	23.5	—	—
Diameter, inches	2.5	4.25	—	—
Weight, pounds	7.13	21.1	—	—
Color	White	Red	Amber	Green
Intensity, candlepower	50,000	207,000	80,600	108,500

Use: Target Flare M50 has the same use as Target Flare Mk 1. Target Flares M77, M78, and M79 are assembly markers from which succeeding elements of a forming squadron or group of aircraft can form a target under conditions of poor visibility and congested traffic patterns.

Description and operation: These are the same as for Target Flare Mk 1.

Remarks: These flares are not under procurement by the Navy at present.

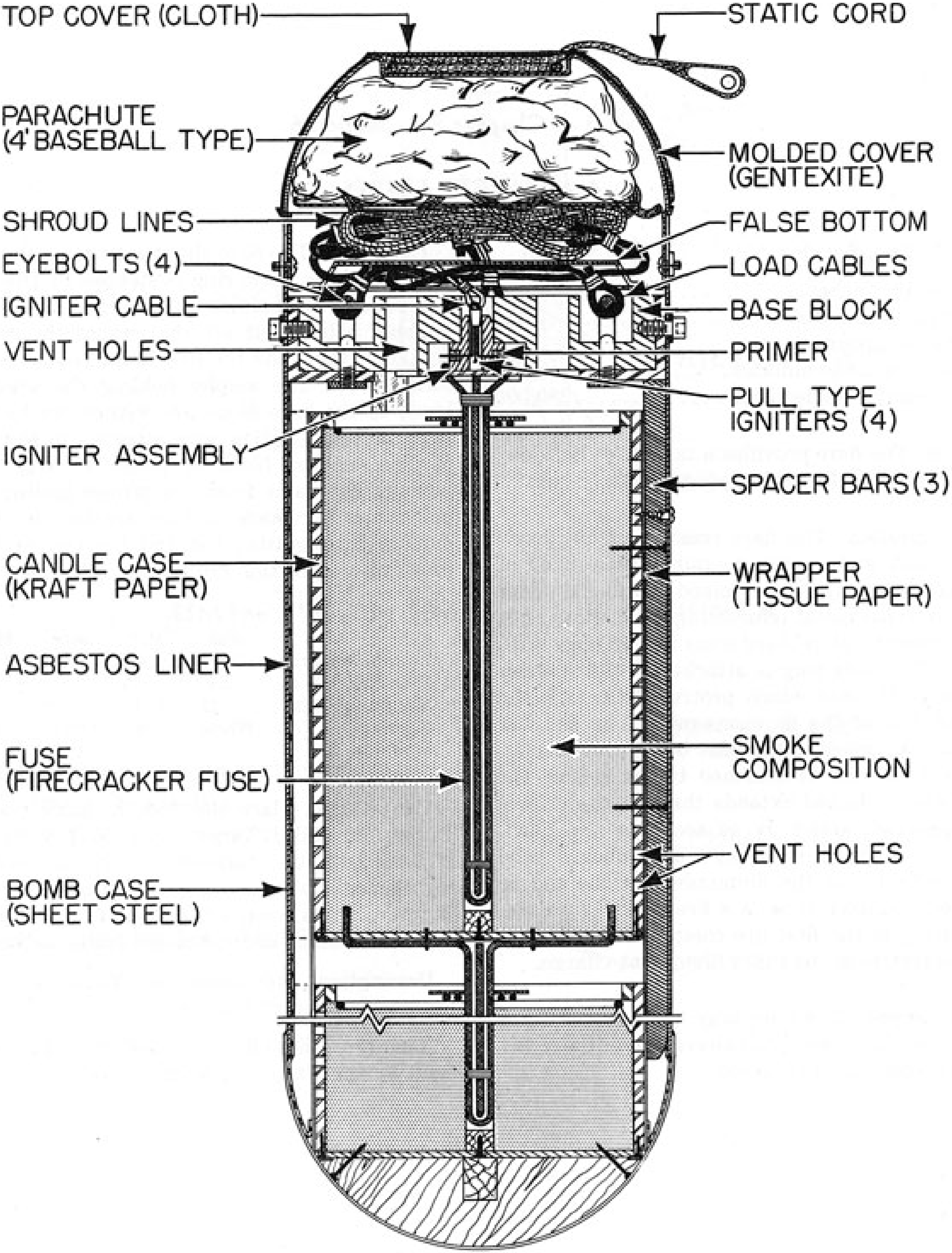


Figure 189. Target Identification Bomb Mk 72 Mod 1

TARGET IDENTIFICATION BOMBS

Mk 72 Mod 1

Length, inches 36
Diameter, inches 8¾
Filling .... Smoke Composition (68% fire orange dye, 15% lactose, 12% potassium chlorate, and 5% asbestos shorts)
Total weight, pounds.................... 45
Fuzing .... 4 pull-type igniters

Construction: This target identification bomb consists of two units, a sheet-steel bomb body casing and a parachute assembly packed in a molded container or pack which is attached to the bomb body by means of four bayonet joints. The parachute pack houses a four-foot baseball-type parachute, the chute shroud lines, the load cables, the igniter cable, and a static cord which extends out of the top of the pack. Bomb body casing contains a base block in the tail which incorporates the igniter assembly, 12 vent holes, and four eye bolts. Load cables are attached to the eye bolts; igniter cable is attached to the pull-type igniters. Between base block and the nose are the upper and lower candle assemblies.

Suspension: Horizontal suspension is provided by two lugs 14 inches apart, welded onto suspension bands which are bolted to the bomb case.

Operation: Upon release of the bomb, the static cord is retained by the rack or shackle to which it is attached. The static cord, through a series of short lines inside the pack, removes the molded cover of the pack and pulls the parachute out. After the parachute is out, the static cord separates from the parachute and is retained by the rack or shackle. As parachute opens, the igniter cable jerks out the four pull igniters, which ignite the primers. The primers ignite the firecracker fuse running through the upper candle, which in turn ignites the candle The candle burns from the inside toward the outside, evolving colored smoke that permeates holes in the candle case and escapes through vent holes in the bomb case. The lower candle is ignited by the firecracker fuse about the time the upper candle burns out.

The total burning time is approximately five minutes, during which time the bomb produces a red-orange smoke in sufficient volume to be seen at 15,000 feet for 10 miles, under normal conditions.

Remarks: Target Identification Bomb Mk 72 Mod 1 is used by air-coordinator planes or by scout planes from battleships to pin-point shore targets.

This colored smoke marker is for use over land only, as the bomb does not float.

Greatest accuracy can be obtained by releasing the bomb from altitude of 500 to 1,000 feet.

This bomb can be carried on all external double-suspension racks and shackles. In addition to the use of this bomb on double-suspension racks or shackles, it can be suspended from the Bomb Adapter Mk 5 Mod 0 (used with Launchers Mk 5 and Mods) when that item is available. These bombs have been successfully released from external suspension on all types of planes in any flight attitude. They can successfully withstand catapult launching and arrested landings.

M75A1 and M84A1

Over-all length, inches.................. 53.1
Body length, inches.................... 39.0
Body diameter, inches.................. 8.2
Wall thickness, inch.................... 0.06
Tail length, inches..................... 12.9
Tail width, inches...................... 10.9

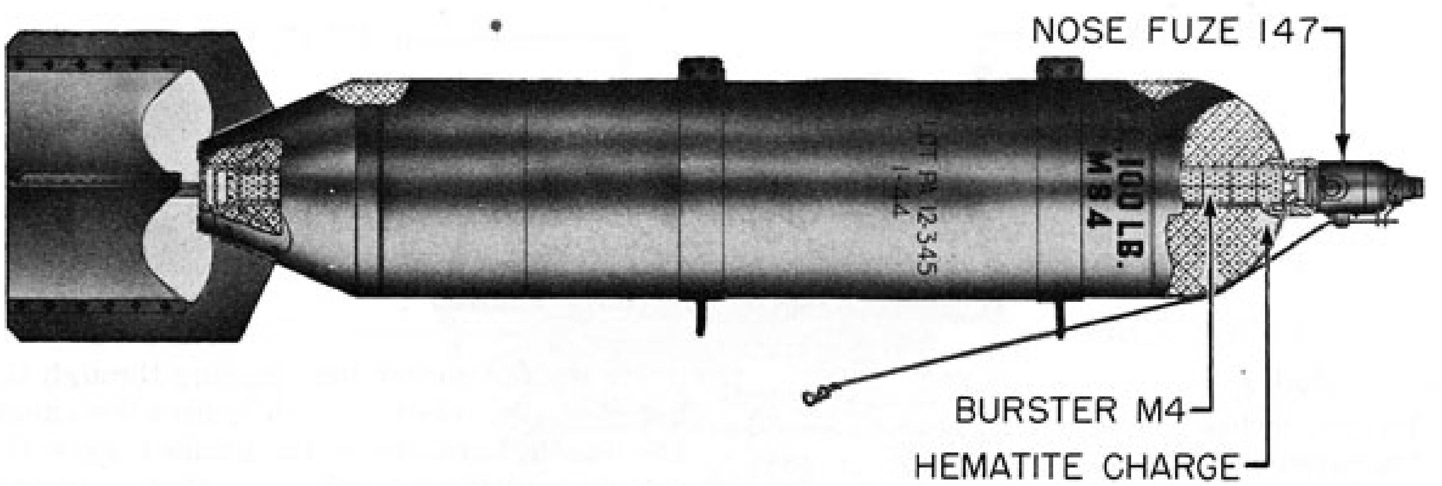


Figure 190. Target Identification Bomb M84

Filling...........Red iron oxide (hematite)
Weight of filling, pounds................72
Total weight, pounds...................102
Fuzing—M84A1 ....AN–M147
M75A1 ....M108

Construction: Target Identification Bombs M84A1 and M75A1 are identical with the exception of the fuze, and the two bombs are similar in construction to the Chemical Bomb AN–M47A2. The body is of sheet metal with box-type tail fins welded to the conical section. The Burster M4 runs through the entire length of the bomb and is closed at the forward end by a closing plug. A filling plug is placed in the fin cone of the bomb body, to facilitate loading the hematite charge (red iron oxide). The fuze fits into the forward end of the burster.

Remarks: The Target Identification Bomb M84A1 is intended for release by the lead or "pathfinder" plane to indicate the bomb-release line for bombers in formation when operations are carried out above an overcast and ground targets are not visible. The bomb was designed to produce a red smoke cloud which would remain at the bursting point for a period of ten minutes under normal air conditions and would be visible for a distance of 15 miles at an altitude of 25,000 feet.

The M75A1 is used for target identification in practice, to mark targets on snow-covered bombing ranges.

M89, M90, M91, M98, and M100

Over-all length, inches..................51.8
Body length, inches....................35.8
Body diameter, inches..................10.8
Wall thickness, inch....................0.27
Tail length, inches.....................15.7
Tail width, inches......................14.9
Type of filling........61 pyrotechnic candles (red, green, or yellow)
Weight of filling, pounds................95
Total weight, pounds.............240—265
Fuzing AN–M146, M144

Construction: The body is a modified 250-pound G.P. Bomb AN–M57 body with a metal closing cup riveted to the base. An integral booster of four ounces of black powder is placed immediately behind the fuze-seat liner and serves as an expelling charge. A wooden nose piece fits around this booster, and a steel piston, in turn, is seated in the base of the nose piece. A steel tube or piston stem is welded through a hole in the piston and extends from the black-powder booster to the plywood ignition disc in the center of the bomb. Six wooden thrust members reach from the piston plate to the tail closing cup and serve to transmit stress to this cup without imposing any of the force on the candles. Felt $\frac{1}{8}$ inch in thickness lines the entire interior cylindrical surface of the bomb. The 61 candles are in two banks of 30 and 31, and have their ignition ends facing toward the quick-match strands stapled on the ignition disc which separates the two banks.

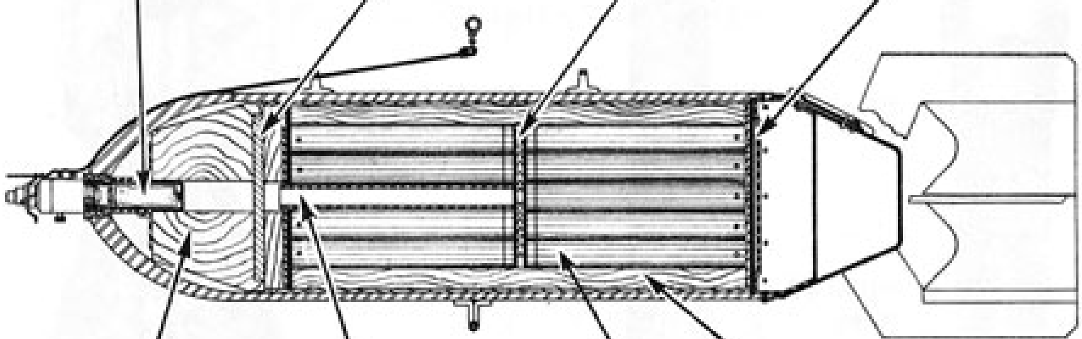


Figure 191. Target Identification Bombs M89, M90, M91, M98, and M100

Tail construction: The tail, in appearance, is a standard box-type tail. It is attached to the bomb by means of four spring latches fitting into cut-outs in the tail closing cup and can be locked in place by stamped steel strips pivoting over the ends of the springs.

Suspension: Horizontal suspension is provided by standard lugs, 14 inches apart.

Operation: When the aerial-burst fuze functions, the fuze booster ignites the black-powder booster or expelling charge in the bomb. The force of the expending gases from the booster, acting through the piston and thrust members, throws off the fin assembly and expels the candles.

Simultaneously, flash from the booster passes through the piston stem to the plywood ignition disc and the quick match, igniting the candles.

Remarks: The bombs are used to form a pattern of red, green, or yellow colored light approximately 100 yards in diameter around or on a target; the light should be visible fom altitudes of 25,000 to 35,000 feet day or night. They are used to spot individual targets, once the general target area has been marked by flares dropped by pathfinder planes. The explosive charge in the Candles M105 is ignited by the flare composition at the end of burning. These charges serve to prevent any removal of the candles by the enemy, once the candles are on the ground.

The M89 contains 61 Non-Delay Candles M103.

The M90 contains 57 Non-Delay Candles M103 also; two Exploding Candles M105, burning for one minute, and two exploding candles burning for two minutes.

The M91 has 16 Non-Delay Candles M103, 15 red 2¾-minute Delay Candles M104, 15 4-minute Delay Candles M104, and 15 5¼-minute Delay Candles M104.

The M98 contains 31 Non-Delay Candles M103, 10 Exploding Candles M105, burning for one minute, 10 Exploding Candles M105, burning for 1.5 minutes, and 10 Exploding Candles M105, burning for two minutes.

The M100 contains Two-Color Combination Candles M104.

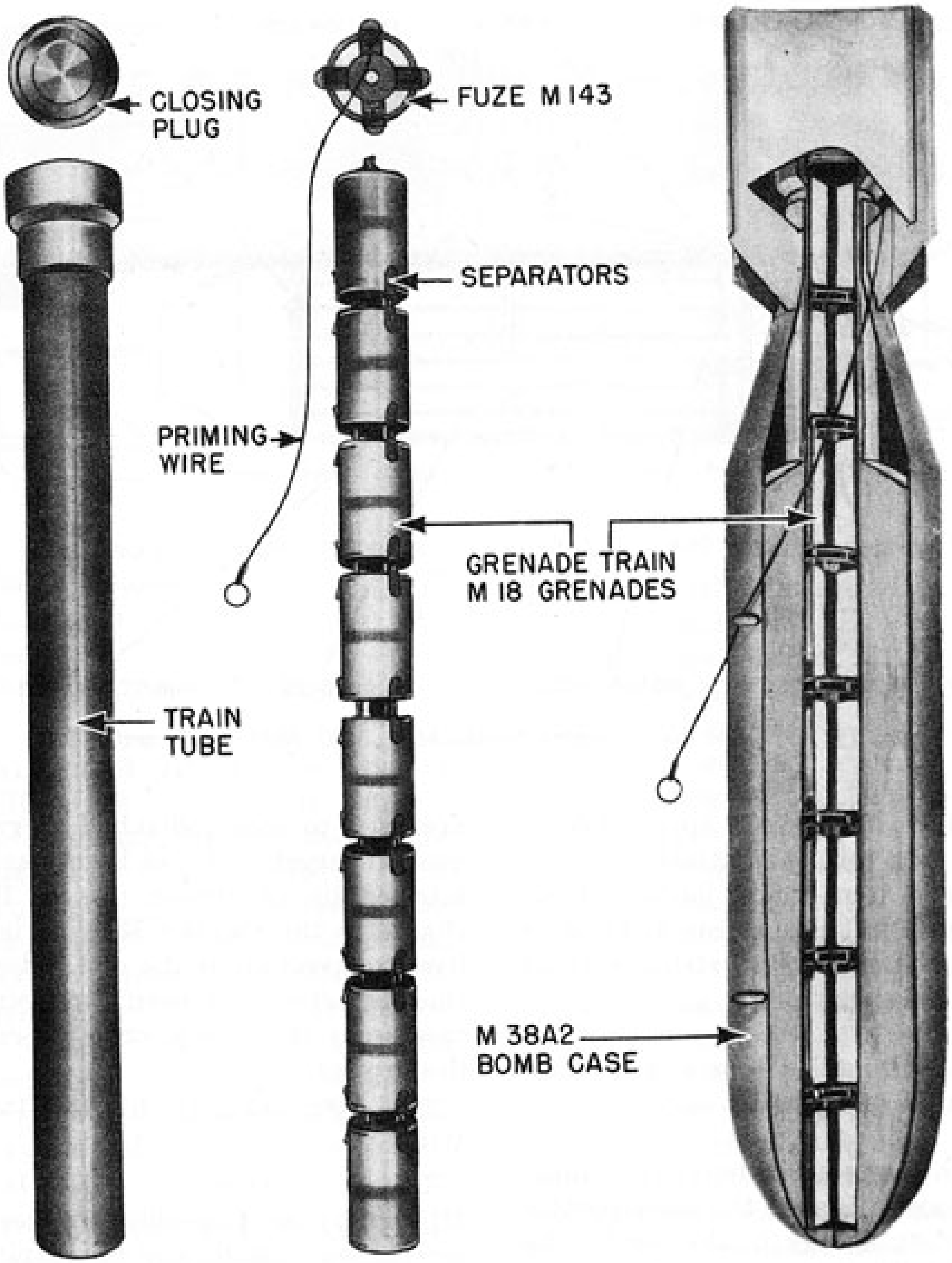


Figure 192. Smoke Streamer Bomb T29

SMOKE STREAMER BOMBS

T29

Over-all length, inches	47.5
Body length, inches	40.5
Body diameter, inches	8
Wall thickness, inch	0.06
Tail length, inches	11.5
Tail width, inches	10.75
Filling	8 Modified Smoke Grenades M18
Total weight, pounds	100

Fuzing: The Fuze M143 consists of a fuze body support mounting four bouchon grenade-type fuzes and an arming washer, and is threaded to fit the fuze adapter of the tube train. The arming washer is 2.5-inch in diameter and has four arms 0.75-inch wide and one inch long. The arming wire holds the arming washer over the bouchon levers until it it withdrawn.

Construction: The bomb body consists of a sheet-steel case with a filling plug in the base. The four tail vanes are welded to the truncated cone with box-type interior struts. The complete body assembly consists of this Practice-Bomb Case M38A2, a train tube, a grenade train, a closing plug, and a fuze. The train tube is a seamless steel tubing three inches in diameter and 40 inches long, with a fuze adapter brazed to the after end. Eight modified Grenades M18 filled with fast-burning mixture are inserted into the tube to form the grenade train. Each grenade is modified by cutting a center hole in its base, and the bouchon fuze is omitted. The top of each grenade is coated with a starter compound which acts as the igniter for the adjacent grenade. Four strands of quick match are knotted and inserted in the center hole of the top grenade in such a manner as to leave the knot and loose ends at the top to receive the fuze flash. The eight grenades are held apart by spring steel separators. A threaded closing plug seals the tube and protects the grenade train from moisture. This plug must be removed just prior to use. The bomb is brought up to the weight of approximately 98 pounds by filling the balance of the internal space with sand.

Operation: When the arming wire is pulled, the bouchon springs throw off the arming washer and handles, allowing the bouchons to fire. This action ignites the quick match in the center hole of the top grenade, which in turn is ignited, and the flash is simultaneously transmitted to all the grenades.

Remarks: The colored streamer smoke bomb is used as a visual signal to be dropped by the lead plane of a bomber formation when the target has been determined. Smoke emission begins approximately one second after release from the plane and continues for approximately 7,000 to 10,000 feet.

PHOTOFLASH BOMBS

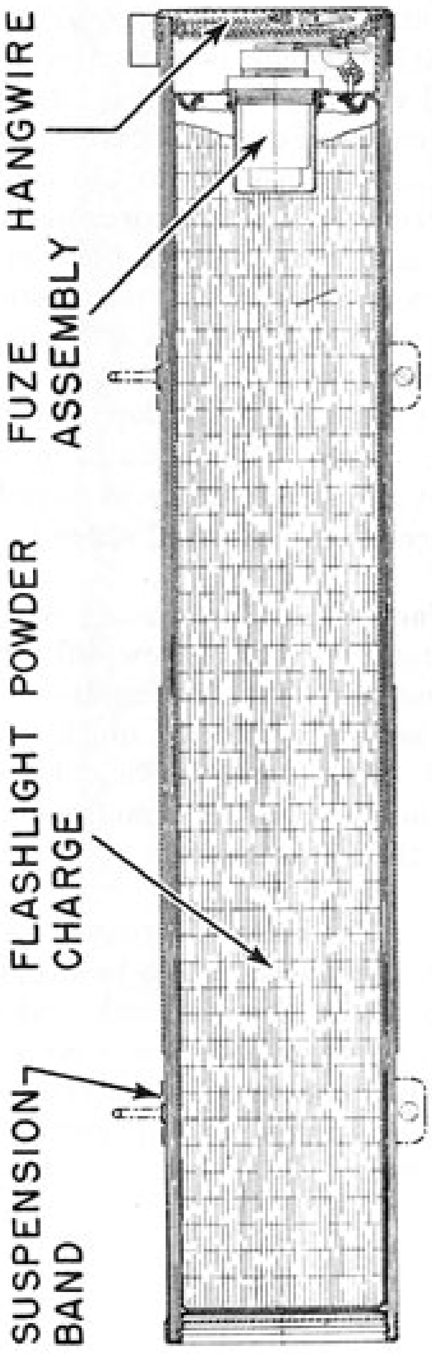


Figure 193. Photoflash Bomb M23A1

M23A1 (Obsolete)

Over-all length, inches	25.4
Diameter of case, inches	4.25
Weight, pounds	10.6
Weight of flash powder, pounds	7.75
Fixed delay, seconds	15
Duration of flash, second	0.20
Intensity of flash, candlepower	150,000,000
Release altitude, feet	4,000—7,000

Use: This bomb is used to provide light of high intensity and short duration for night photography from low altitudes.

Description: The bomb case is made of cardboard and closed with metal ends, one of which is marked "Front" to insure proper loading in the rack. This end contains the hang-wire assembly just before the Fuze Assembly M23A1. The fuze assembly is made up of the friction wires attached to the hang wire, match composition, quick match, delay element, upper and lower rings, and base ignition charge immediately adjacent to the flashlight powder charge. The hang wire is attached to the arming-wire retainer.

Operation: When the bomb is released, the hang wire remains attached to the arming-wire retainer. As the bomb drops, the hang wire pulls the friction wires through the match composition of the fuze. The hang wire also pulls out the hang-wire container, allowing both the hang wire container and the bomb to fall free. The flame from the match composition ignites a piece of quick match, which in turn ignites a delay element. After 15 seconds, the delay element ignites the base charge of the fuze, which sets off the flashlight powder charge. The flash lasts a fifth of a second.

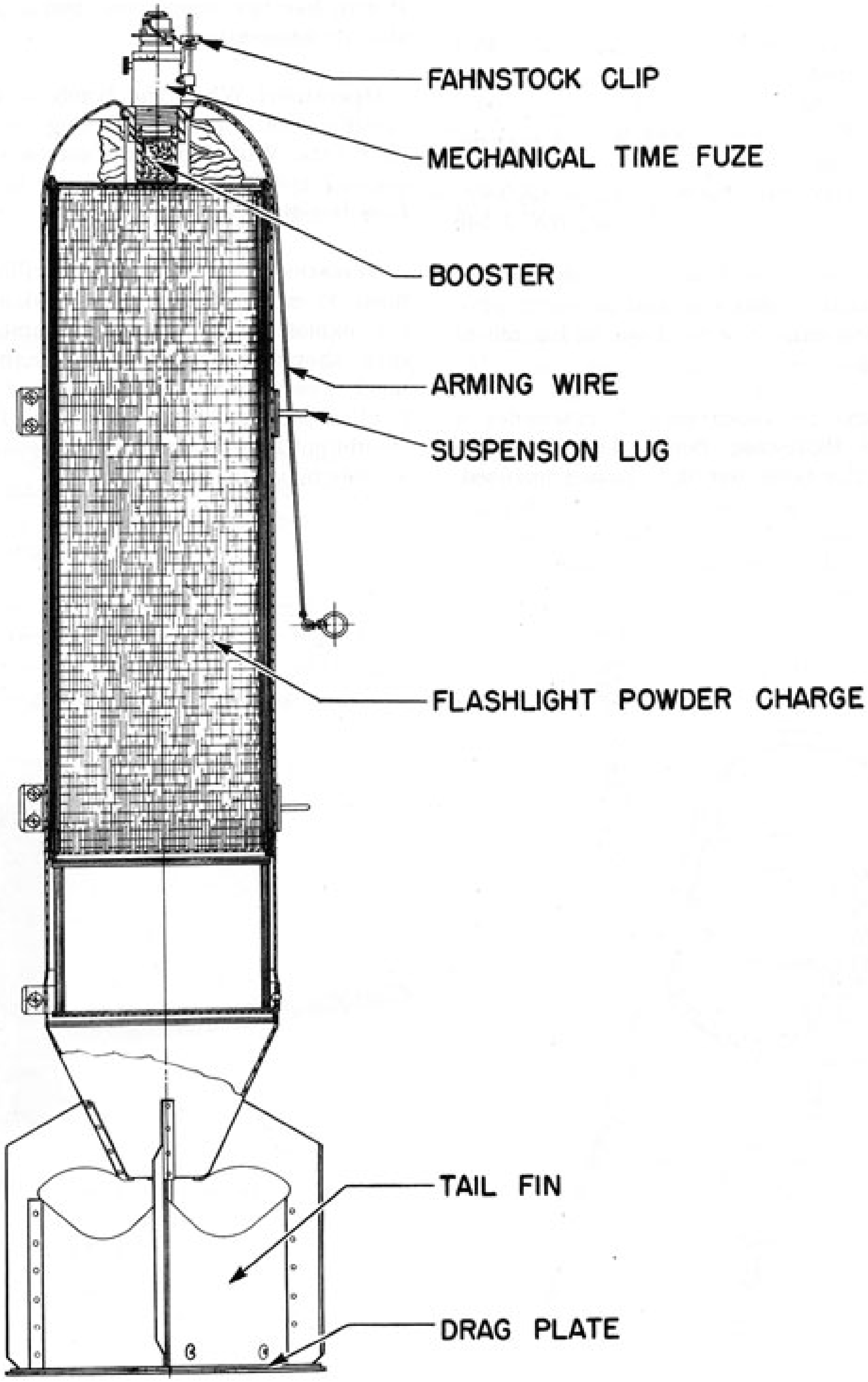


Figure 194. Photoflash Bomb AN–M46

AN–M46

Over-all length, inches................48.4
Diameter, inches 8
Weight, pounds 51.9
Weight of flash powder, pounds..........25
Burning time, seconds................0.20
Peak intensity, candlepower.....500,000,000
Fuzing M111A2, AN–M146

Use: The Photoflash Bomb AN–M46 was developed so that planes engaged in night photography reconnaissance need not be limited to low altitudes.

Description: In appearance it resembles a conventional light-case bomb. Uses a Fuze M111A2 in the nose, but it is issued unfuzed. It also has two suspension bands for rack and shackle suspension.

Operation: When the bomb is dropped, the arming wire is pulled, starting the mechanical time fuze. When the time set on the fuze has elapsed, the flashlight powder is ignited by the fuze booster.

Remarks: Because of the brilliance of the flash, it is detrimental to the vision to watch the explosion of photoflash bombs. Extreme care should be exercised in handling these bombs, because the charge is very sensitive to friction, shock, and temperature. These bombs should not be jettisoned over friendly territory, as they may function on impact.

GROUND PYROTECHNICS

Section I—SIGNALS

One-inch Salute Mk I Mod 0

Length, inches 1.75
Diameter, inch 0.75

Use: This salute is used by the Marine construction battalions and amphibious training commands to simulate battle sounds of loud report and bright flash.

Description: Essentially a commercial-type firecracker, this salute is a spirally-wound paper tube closed at both ends with paper cups. It uses the regular firecracker filling and fuse.

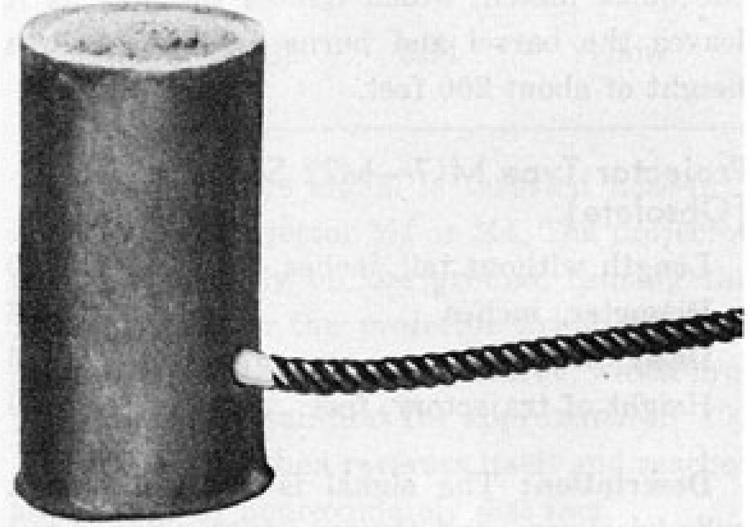


Figure 195. One–inch Salute Mk 1 Mod 0

Firecracker Mk 2 Mod 0

General: This firecracker is used as a practice charge for booby traps and firing devices. It produces a loud report, bright flash, and smoke. It is designed to reduce the hazard of flying particles attendant upon use of a standard potassium perchlorate firecracker. It is classified as fireworks, since it contains no high explosive. Although coated with a waterproofing material, it should be stored in a dry place.

Installation: The coupling base of any standard firing device is pushed through the wax-filled hole in the hollowed end of the firecracker and rotated clockwise until at least two threads of the coupling base are inside the hollowed end.

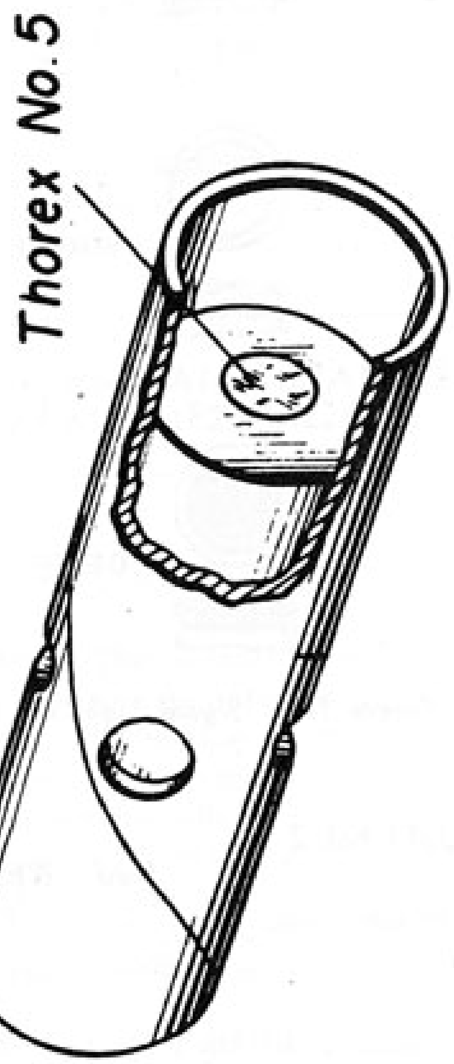


Figure 196. Firecracker Mk 2 Mod 0

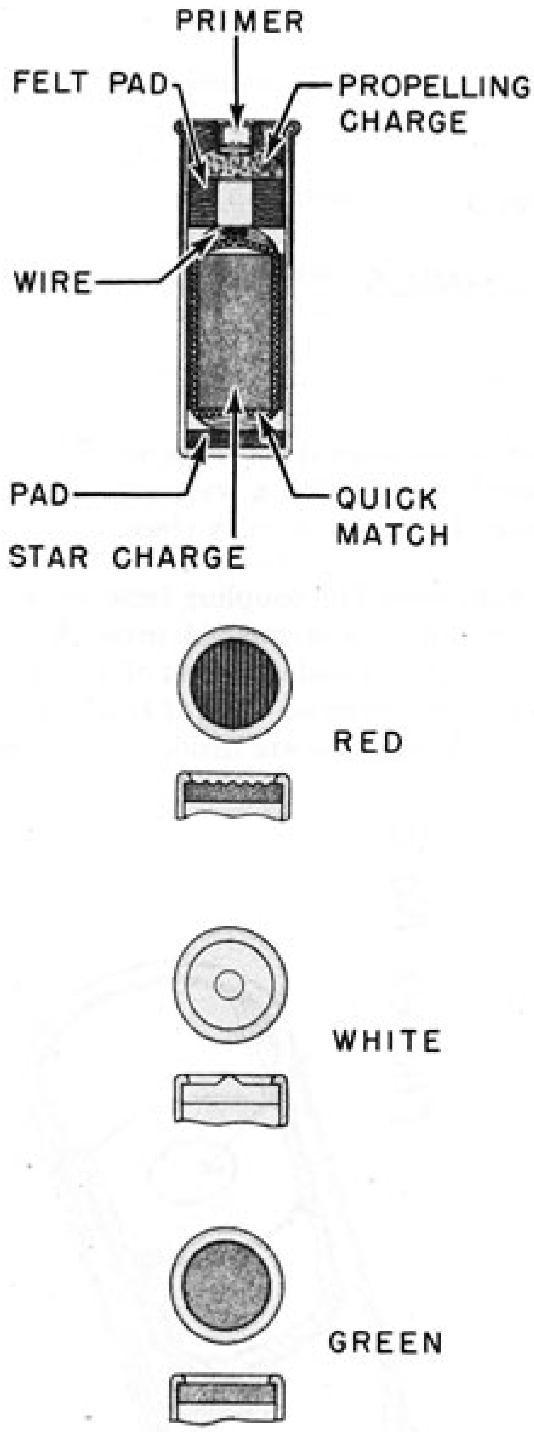


Figure 197. Signal Light Mk 2

Signal Light Mk 2

	Red	White	Green
Burning time, sec.	7	6	5
Candlepower	300	250	600

Use: Signal Light Mk 2 is used primarily as a distress signal.

Description: The cartridge, sometimes called the Very signal, is similar in appearance to a 10-gauge shotgun shell. The star charge is a tightly-packed cylinder of pyrotechnic material reinforced with wire and wrapped with quick match. The propelling charge is composed of about 25 grains of black powder separated from the star charge by a hard felt pad.

Identification of the three types

RED STAR—Paper wrapping is red; closing wad is corrugated.

WHITE STAR—Paper wrapping is white; closing wad has a small cone in the center.

GREEN STAR—Paper wrapping is green; closing wad is smooth.

Operation: The Signal Pistol Mk 5 may be used, as well as the Hand Projector Mk 3 or Mk 4.

The primer ignites the propelling charge, expelling the star out of the projector and igniting the quick match, which ignites the star as it leaves the barrel and burns as it rises to a height of about 200 feet.

Projector Type M17—M22 Series (Obsolete)

Length without tail, inches	6.0
Diameter, inches	1.6
Delay, seconds	6
Height of trajectory, feet	600

Description: The signal is assembled in a cylindrical case, and equipped with a finned tail assembly for stabilization purposes. The primer is located in the head of the signal, and the propelling charge is contained in a small cavity under the head. The end opposite the primer is closed by a press-fit cap to which the tail assembly is attached. The signal has a solid tail stem and an **X**-shaped fin. Embossed letters on the fin indicate the color and type of star(s).

Figure 198. Signal, Ground, White Star, Parachute, M17

IDENTIFICATION OF M17—22 SERIES

	Weight (pounds)	Fin	Embossed Letters	Star(s)
M17	0.68	White	WP	White—parachute-supported star
M18	0.74	White	WS	White—cluster of five stars
M19	0.66	Green	GP	Green—parachute-supported star
M20	0.76	Green	GS	Green—cluster of five stars
M21	0.64	Yellow	AP	Amber—parachute-supported star
M22	0.71	Yellow	AS	Amber—cluster of five stars

Operation: The signal is inserted nose-first into Ground Projector M3 or M4. The projector is struck smartly on the ground, causing the primer to strike the projector firing pin. The primer ignites the propelling charge, which projects the signal tail-first for approximately 100 feet. The signal then reverses itself and reaches an altitude of approximately 600 feet.

High-Bursting Range Signal M 27

The Range Signal M27 is similar to the projector-type signals, except that it has no tail assembly. It is fired only from the Ground Signal Projector M1A1. The signal explodes at the top of its rise, producing a flash and a puff of smoke.

Launcher Type M17A1—M22A1; M51A1; M52A1; and M17A1B2—M22A1B2

Length, inches 10.5
Diameter, inches 1.6
Delay, seconds 6
Height of trajectory, feet..............600

Description: The signal is assembled in a cylindrical case and equipped with a finned tail assembly for stabilization purposes. It is similar to the projector type, but modified to be fired from a service rifle or carbine. This type has a hollow stem, which is closed by a cork plug and a wheel-shaped fin. The "A1B2" series is the same as the "A1" series, except that the former indicates steel construction. Special cartridges are used to ignite the propelling charge. Embossed letters on the closing cap indicate color and type of star(s).

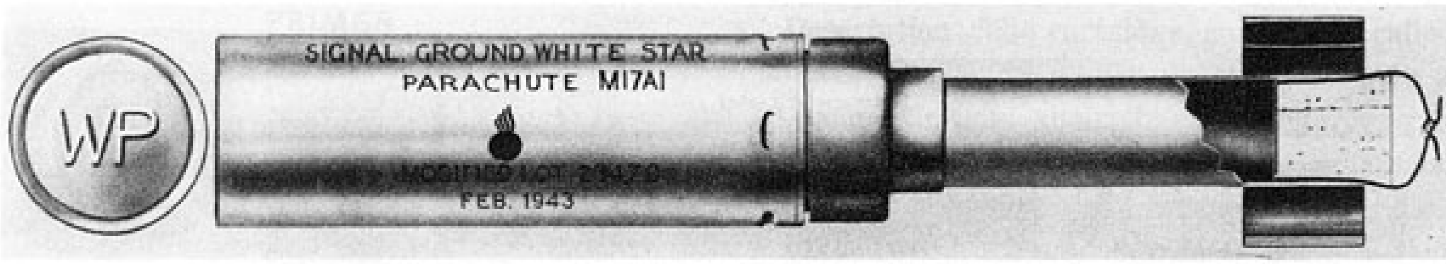


Figure 199. Signal, Ground, White Star, Parachute, M17A1

IDENTIFICATION OF M17A1 THROUGH M22A1 SERIES, M51A1, AND M52A1

	Weight (pounds)	Fin	Embossed Letters	Star(s)
M17A1	1.04	White	WP	White—parachute-supported star
M18A1	1.10	White	WS	White—cluster of five stars
M19A1	1.02	Green	GP	Green—parachute supported star
M20A1	1.10	Green	GS	Green—cluster of five stars
M21A1	1.00	Yellow	AP	Amber—parachute-supported star
M22A1	1.07	Yellow	AS	Amber—cluster of five stars
M51A1	1.02	Red	RP	Red—parachute-supported star
M52A1	1.02	Red	RS	Red—cluster of five stars

Operation: Remove the cork plug from the tail and place the signal on a rifle launcher. Place the butt of the rifle on the ground as far away as practicable. When the rifle is fired, the cartridge fires the primer, which in turn ignites the propelling charge. The signal travels approximately 100 feet and then reverses itself and reaches an altitude of approximately 600 feet.

High-Bursting Range Signal M27A1B1

Length, inches 8.37
Diameter, inches 1.5
Weight, ounces 9.25
Height of trajectory, feet. 700

This signal has the standard tube and fin assembly as the launcher types. It is used in training maneuvers to simulate the air burst of

an artillery shell. It produces a flash and puff of smoke, and a noise audible for at least 2,000 yards.

Flash and Sound Signal M74

General: The Flash and Sound Signal M74 is designed for simulation of air burst of artillery fire in training troops. It is fired from the Hand Projector M9 or the Pyrotechnic Pistol AN–M8.

Description: The signal consists of an outer case, an expelling charge, and an inner cylindrical case containing the delay fuze and bursting charge. The outer case resembles those of the aircraft double-star type. A percussion primer in the base of the outer case extends into the expelling charge. The expelling charge sets off the delay fuze.

Operation: When fired, the primer ignites the expelling charge. This ignites the delay fuze and propels the inner case out of the outer case. After a delay of about two and a half seconds, the fuze ignites the burster charge which, in exploding, produces a bright flash and a loud noise.

Remarks: With the pistol or projector at 45° elevation, the signal will reach a height of about 100 feet for its burst. Helmets should be worn by exposed personnel.

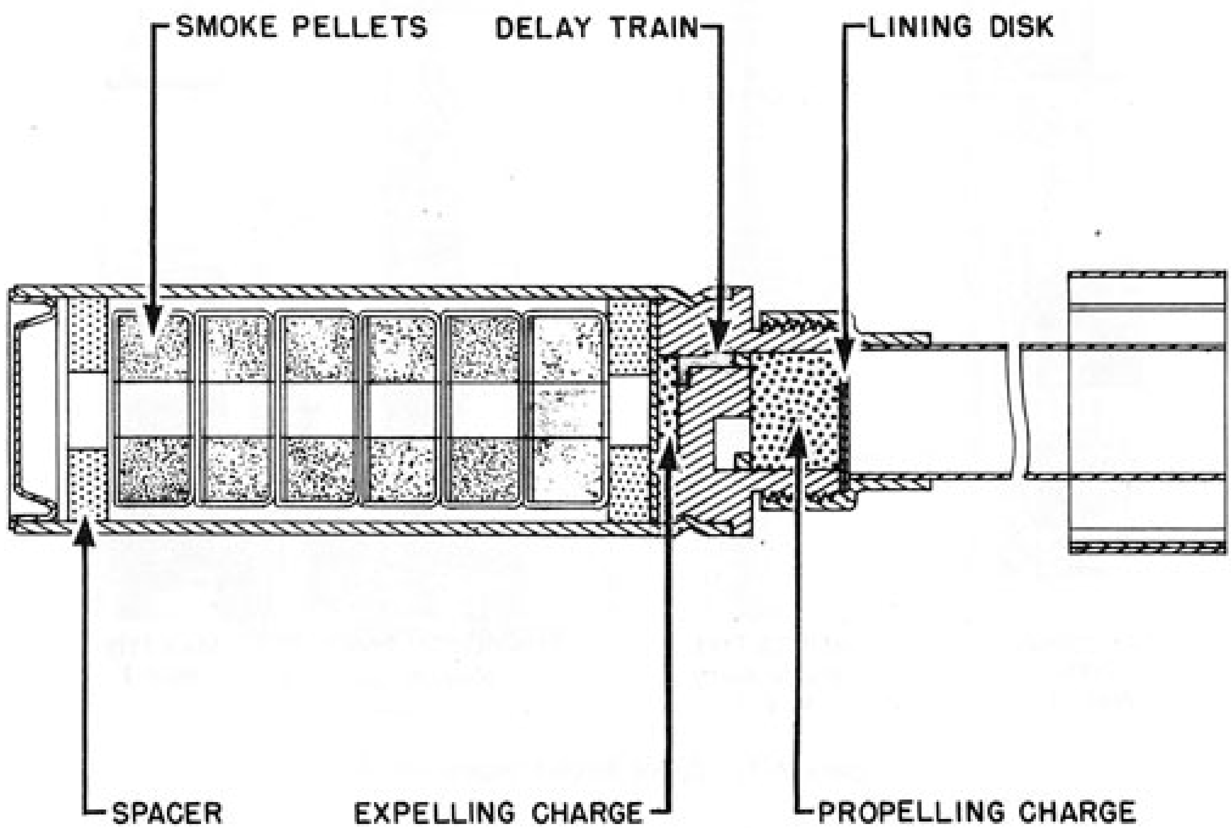


Figure 200. Smoke Signals M62, M64, M65, and M66

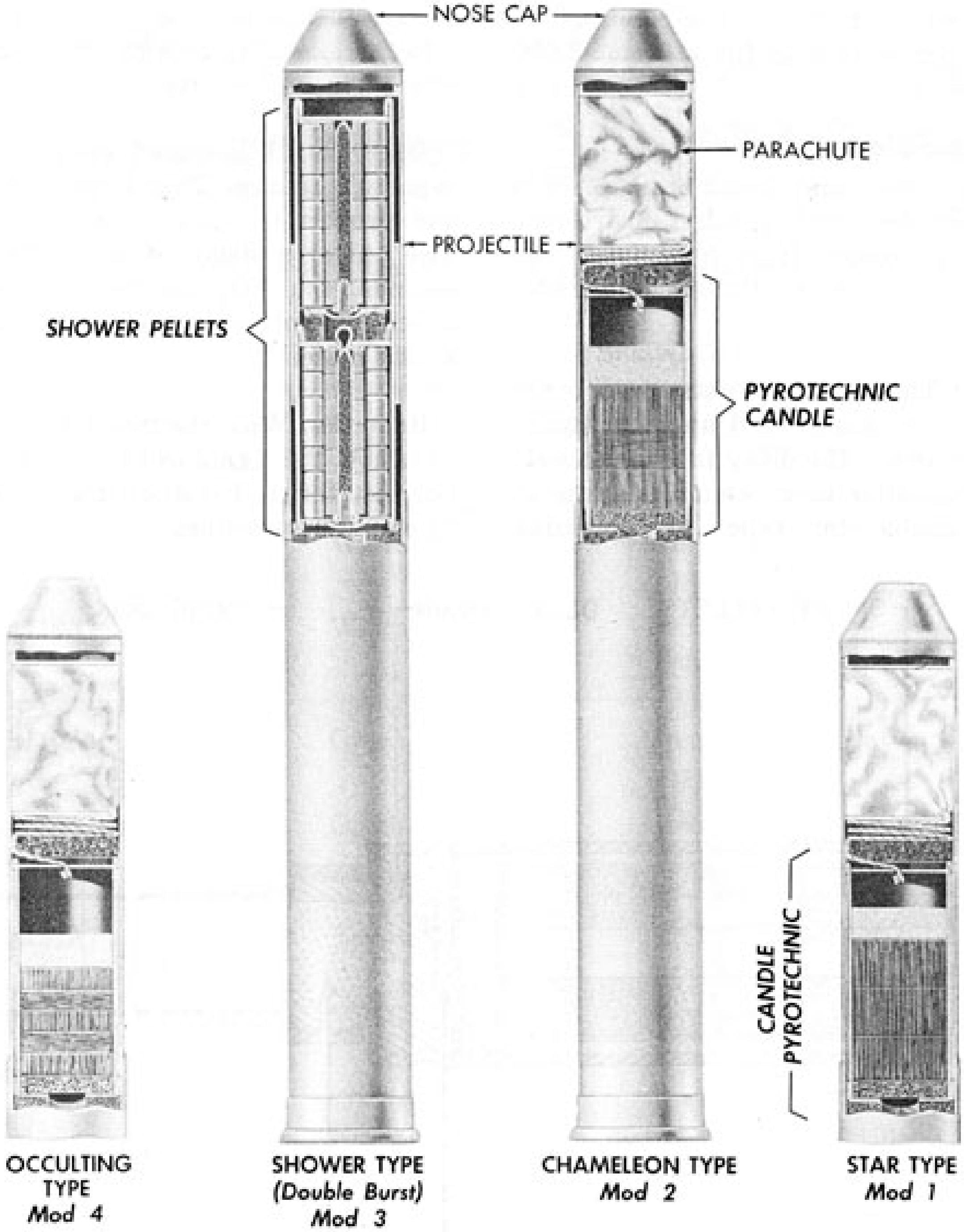
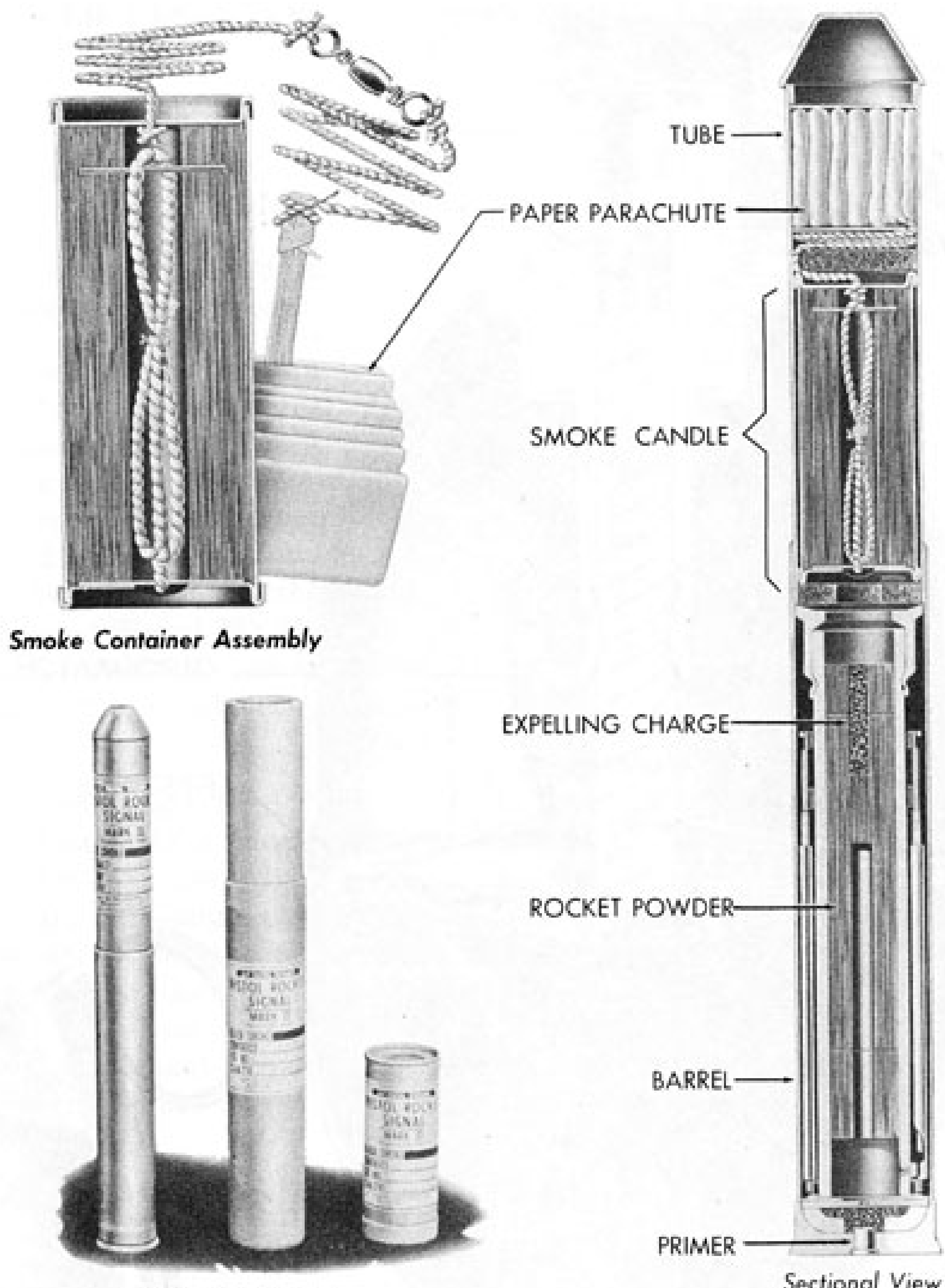


Figure 201. Pistol Rocket Signal Mk 1



Smoke Container Assembly

Full View Showing Waterproof Container

Sectional View

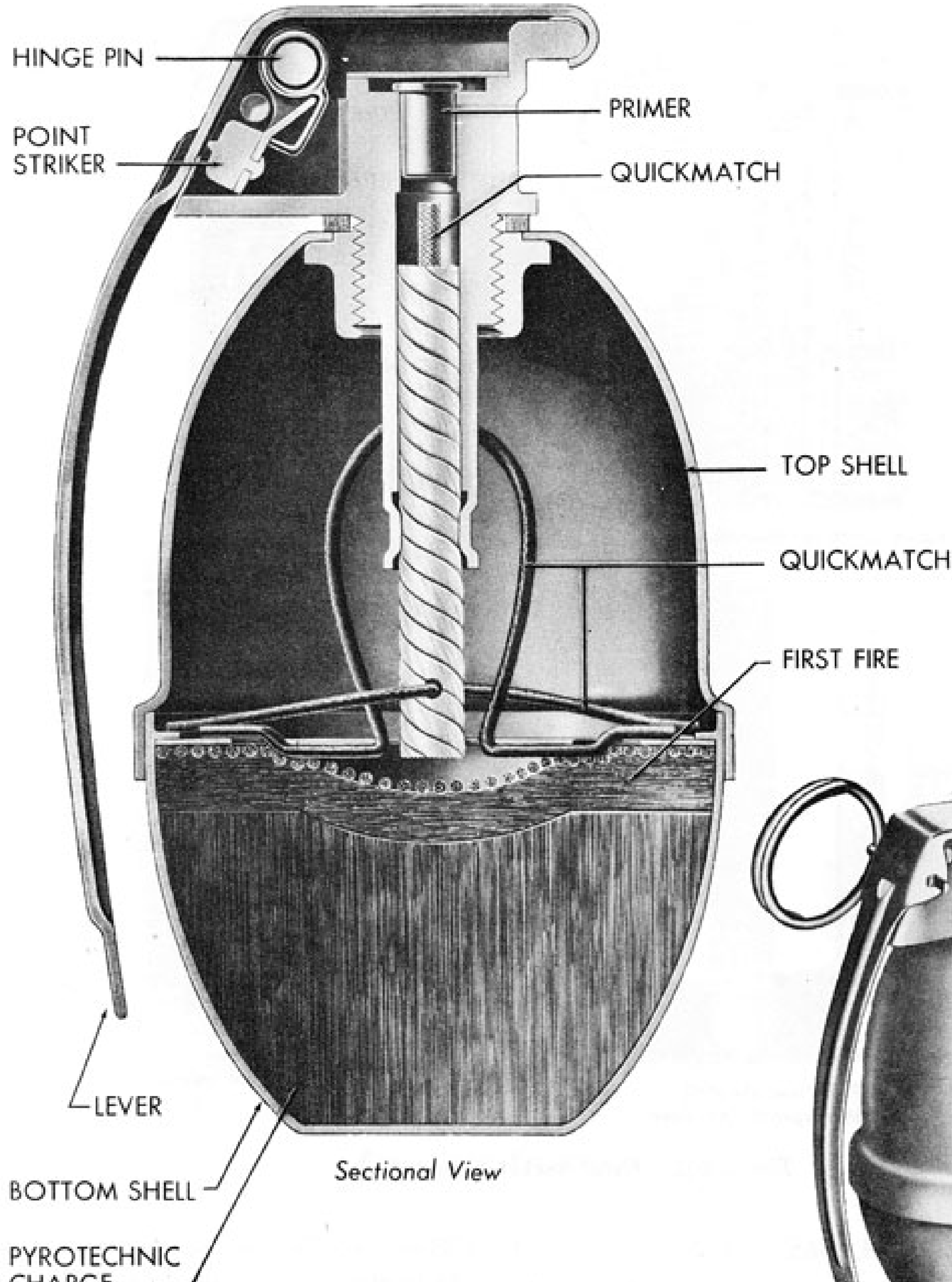
Figure 202. Pistol Rocket Signal Mk 2

Smoke Signals M62, M64, M65, and M66

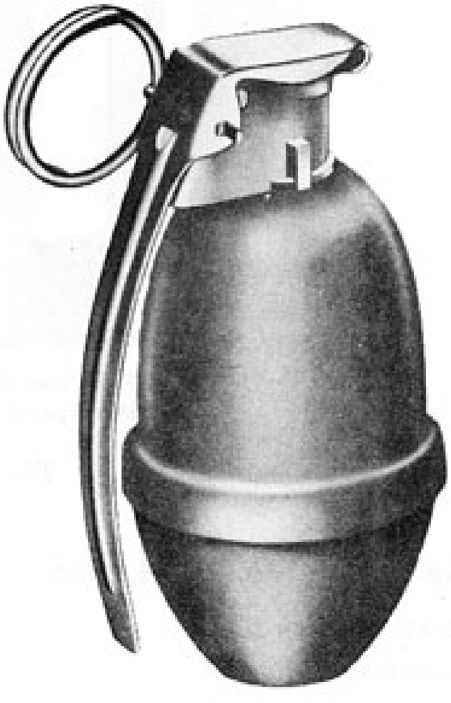
Length, inches		10.15
Diameter, inches		1.88
Bursting altitude, feet		600
Colors—	M62	Red
	M64	Yellow
	M65	Green
	M66	Violet

Use: These signals are employed by artillery observers to signal or lay in a line of fire.

Description and operation: The signal is launched in the same manner as the M17A1 series. The fuze delay ignites an expelling charge, which expels and ignites the six smoke pellets at an altitude of 600 feet. The pellets burn and fall, leaving a colored smoke trail.



Sectional View



Full View

Figure 203. Illuminating Hand Grenade Mk 1

Pistol Rocket Signals Mk I Mod 2 and Mk 2 Mod I

Length, inches	14.0
Diameter, inches	1.5
Burning time, seconds	21
Weight, pound	1

Use: These signals are for identification on other signaling between ground troops.

Description: Similar in construction to the submarine signal, Pistol Rocket Signal Mk 1 Comet, the Pistol Rocket Signal Mk 1 Mod 2 produces a chameleon signal consisting of three parachute-borne stars which burn successively in three colors. Each star burns for approximately seven seconds before the next color ignites. The Pistol Rocket Signal Mk Mod 1 is a smoke signal, a parachute-borne smoke candle, but is generally the same construction as the Mk 1 Mod 2.

Operation: The signals are fired from the Submarine Rocket Pistol Mk 1 Mod 0 or the Pyrotechnic Pistol AN–M8. The primer ignites the one-gram auxiliary expelling charge, which projects the upper section of the signal to a height of 30 feet, where the rocket powder ignites, sending the signal on up to 650 feet. There the pyrotechnic element—chameleon or smoke—ignites. As the signal leaves the projector or pistol, the spring-loaded vanes fold out into place, stabilizing the flight of the signal.

Illuminating Hand Grenade Mk I

Length, inches	4.3
Diameter, inches	2.1
Weight, ounces	9.2
Intensity, candlepower	60,000
Delay, seconds	7
Burning time, seconds	25

Description: The grenade consists of two metal shells pressed together and sealed. The upper shell contains a Bouchon igniter and a delay fuse. The bottom shell contains the illuminant composition, first fire charge, ignition charge, quick match, and disc.

Operation: Pull the release pin and throw the grenade. When the lever is released, the firing pin is freed to fire the primer. The primer ignites the delay fuse, which burns for seven seconds and then ignites the ignition charge. The ignition charge sets off the first fire composition, which in turn ignites the illuminant composition. The gases from the ignition charge and first fire force the two shells apart, thus leaving the illuminant composition of the bottom shell free for burning.

Part 3 — Chapter 9 — Section 3

FLARES

Parachute Trip Flare M48

Diameter of flare tube, inches	2.5
Height of trajectory, feet	300—500
Burning time, seconds	20
Intensity, candlepower	100,000
Color	White to yellowish
Effective illumination	Circle of 300 yards radius

Use: The flare is used to give warning of enemy marauders or infiltrating hostile troops; also, for illumination or signaling.

Description: The flare consists of a ¼-inch pipe and a steel tube approximately 2.5 inches in inside diameter, which are attached to a base plate that contains a 75-grain propelling charge. The steel tube contains a delay fuse, an expelling charge, a candle, and a parachute assembly. The 0.25-inch pipe and the firing mechanism are joined by a coupling, and the pipe is

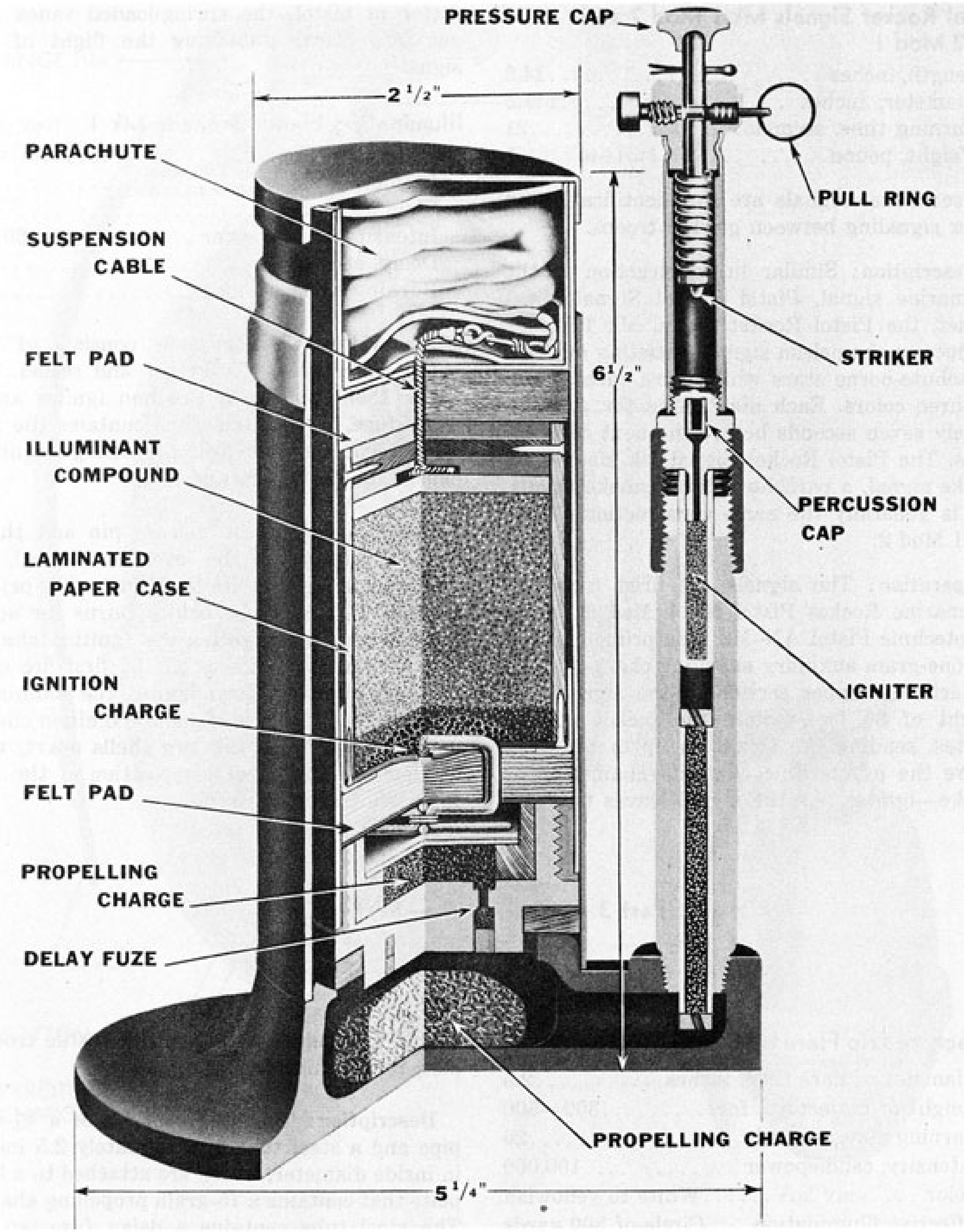


Figure 204. Parachute Trip Flare M48

threaded to the base plate. The firing train is composed of a primer, an igniter, and a relay charge. The firing mechanism contains the pressure cap, pull ring and pin, safety screw, safety cotter pin, and spring-loaded firing pin.

Operation: A 20- to 30-pound pressure on the pressure cap or a tension of four to six pounds on the pull pin releases the firing pin and fires the primer. The primer initiates the igniter, which, in turn, starts the relay charge. The relay charge sets off the propelling charge, which projects the illuminating shell through the large steel tube to a height of 300 to 500 feet. The propelling charge ignites a three-second delay fuse in the shell. The delay fuse ignites an expelling charge which expels a parachute-supported candle from the shell.

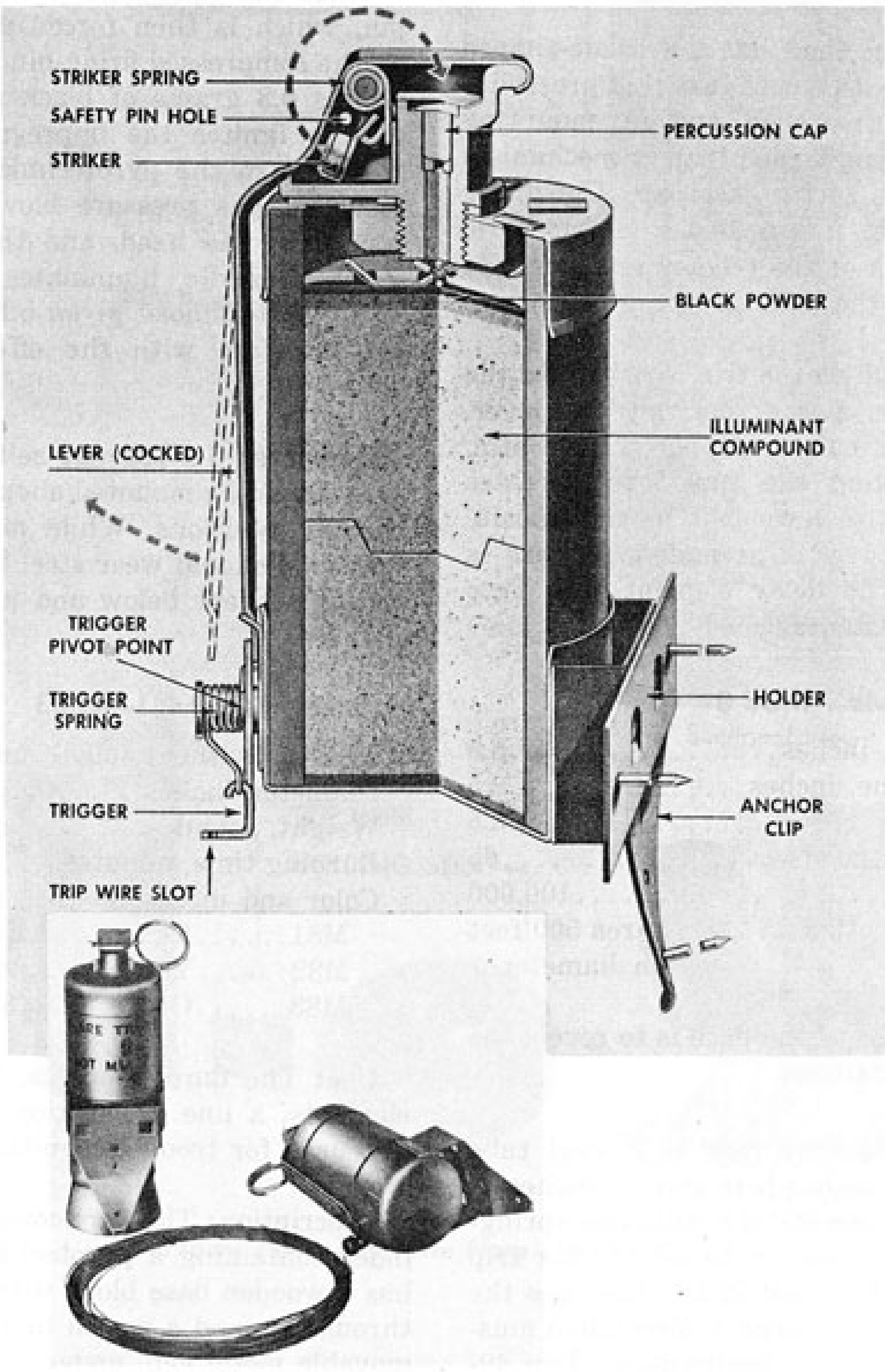


Figure 205. Trip Flare M49

Trip Flare M49

Length, inches	3.8
Diameter, inches	2.5
Burning time, minute	1
Intensity, candlepower	40,000
Color	White to yellowish

Use: The Trip Flare M49 has the same uses as the Parachute Trip Flare M48.

Description: The flare has a grenade-shaped cylindrical body, with a nose fuze that protrudes 0.875-inch from the head end. A mounting bracket and a spring-loaded trigger mechanism are mounted on a metal base cap. The upper arm of the trigger is attached to a trip wire, and the lower arm of the trigger restrains the safety lever after the removal of the safety pin.

Operation: A pull on the trip wire rotates the upper trigger arm away from the fuze lever. If the trip wire is cut, the upper trigger arm, which is restraining the fuze lever, rotates away from the fuze lever but in an opposite direction from above. A grenade-type fuze is used, but it has no delay element. The fuze ignites the flare instantaneously.

Trip-Wire Flare Mk I Mod 0

Length of tube, inches	5.5
Diameter of tube, inches	2.5
Weight, pounds	3.5
Burning time, seconds	65
Candlepower	100,000
Effective illumination	Area 500 feet in diameter

Use: The purpose of the flare is to reveal the approach of enemy troops.

Description: The flare case is a steel tube approximately 5.5 inches long and 2.5 inches in diameter. Fixed to one end is a pull-type, spring-actuated firing mechanism to which the trip wire is attached. Enclosed in the tube are the primer, black-powder charge, impregnated muslin disc, and pyrotechnic composition. Two 40-foot lengths of wire are available, making it possible to have two trip wires running in opposite directions. A web belt secures the flare to a tree.

Operation: A tug of three pounds or more on the trip wire draws the plunger and firing pin away from the primer and compresses a spring which surrounds the firing pin. As the plunger is pulled away from the firing mechanism, its notched end disengages from that of the firing pin, which is then forced against the primer by the compressed firing-pin spring. The primer ignites 0.3 grams of black powder. The black powder ignites the impregnated muslin disc, and in turn the pyrotechnic composition. The resultant gas pressure blows out the closure disc from the head, and the flame from the burning candle illuminates the surrounding area. White smoke given off by the flare does not interfere with the effectiveness of illumination.

Remarks: To prevent self illumination, the flare should be mounted about 125 yards before friendly positions. While mounting the flare, personnel should wear steel helmets, and heads should be kept below and away from the top of the flare.

Ground Flare M81—M83

Length (without spike), inches		7.75
Diameter, inches		1.75
Weight, pound		0.88
Burning time, minutes		2
Color and intensity		
M81	Red	20,000 candlepower
M82	Yellow	25,000 candlepower
M83	Green	35,000 candlepower

Use: The flare indicates, to cooperating air elements, a line of position or direction. It is also used for troop-recognition purposes.

Description: The flare consists of a paper cylinder containing a pyrotechnic composition. It has a wooden base block with a 20-penny spike through it, and a match head covered by a removable metal cap, under which lies a wooden disc. A plastic film seals the metal cup to the

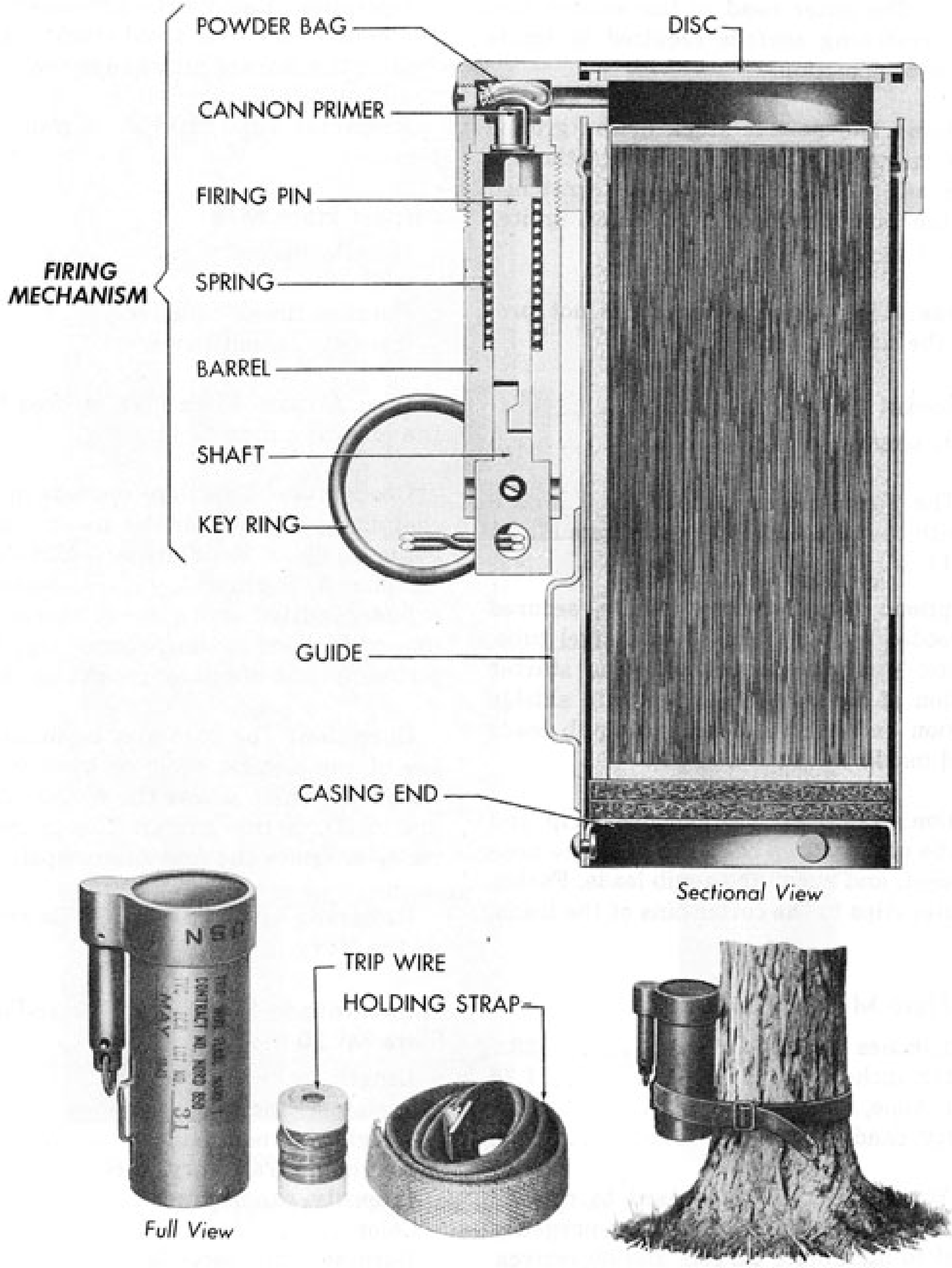


Figure 206. Trip-Wire Flare Mk 1 Mod 0

flare body. The outer head of the wooden disc has the scratching surface required to ignite the match composition.

Operation: The flare is stuck in the ground with the spike as a support. The plastic seal is pulled off and the wooden disc scratched against the match composition, which ignites the flare.

Remarks: These ground flares are not procured by the Navy at present.

Target Rocket Flare Mk 1 Mod 0

Weight, pounds 3

Use: The Target Rocket Flare Mk 1 Mod 0 is used with the 3.25-inch Rocket Targets Mk 10 and Mk 11.

Description: A pyrotechnic candle, secured into a wooden body, is housed in a steel tube. An electric squib is located over the starter composition of the candle. A steel cup shields the ignition end of the flare, and squib leads are coiled inside the nose cap.

Operation: Tear off the adhesive strip and remove the cover. Place the flare over the nose of the rocket, and uncoil the squib leads. Fasten the alligator clips to the cotter pins of the leads, and fire.

Airport Flare M13 (Obsolete)

Length, inches 23.1
Diameter, inches 1.75
Burning time, minutes 3
Intensity, candlepower 40,000

Use: Airport Flare M13 is used to provide illumination for airplane landing at emergency fields, and to illuminate targets and objectives. A further use is to prevent infiltration or surprise by enemy troops.

Description: The flare consists of a cylinder; the top cover sealed with a strip of adhesive tape, and a seven-inch hollow chip-board tube mounted to one end of the cylinder.

Operation: Remove the adhesive tape and slip the hollow tube over a rod stuck in the ground. Pull on the lanyard attached to the ignition wire to fire the flare.

Remarks: This flare is not procured by the Navy.

Airport Flare M76

Length, inches 32.0
Diameter, inches 6
Burning time, minutes 6.5
Intensity, candlepower 800,000

Use: Airport Flare M76 is used to indicate the end of a runway in a fog.

Description: This flare consists of a cylinder containing a candle similar to—but larger than—the candle of the Flare AN–M26 described in Chapter 8, Section 5, of this pamphlet. The cylinder is fitted with a socket base arrangement into which four channel-shaped legs may be inserted to hold the flare upright on the runway.

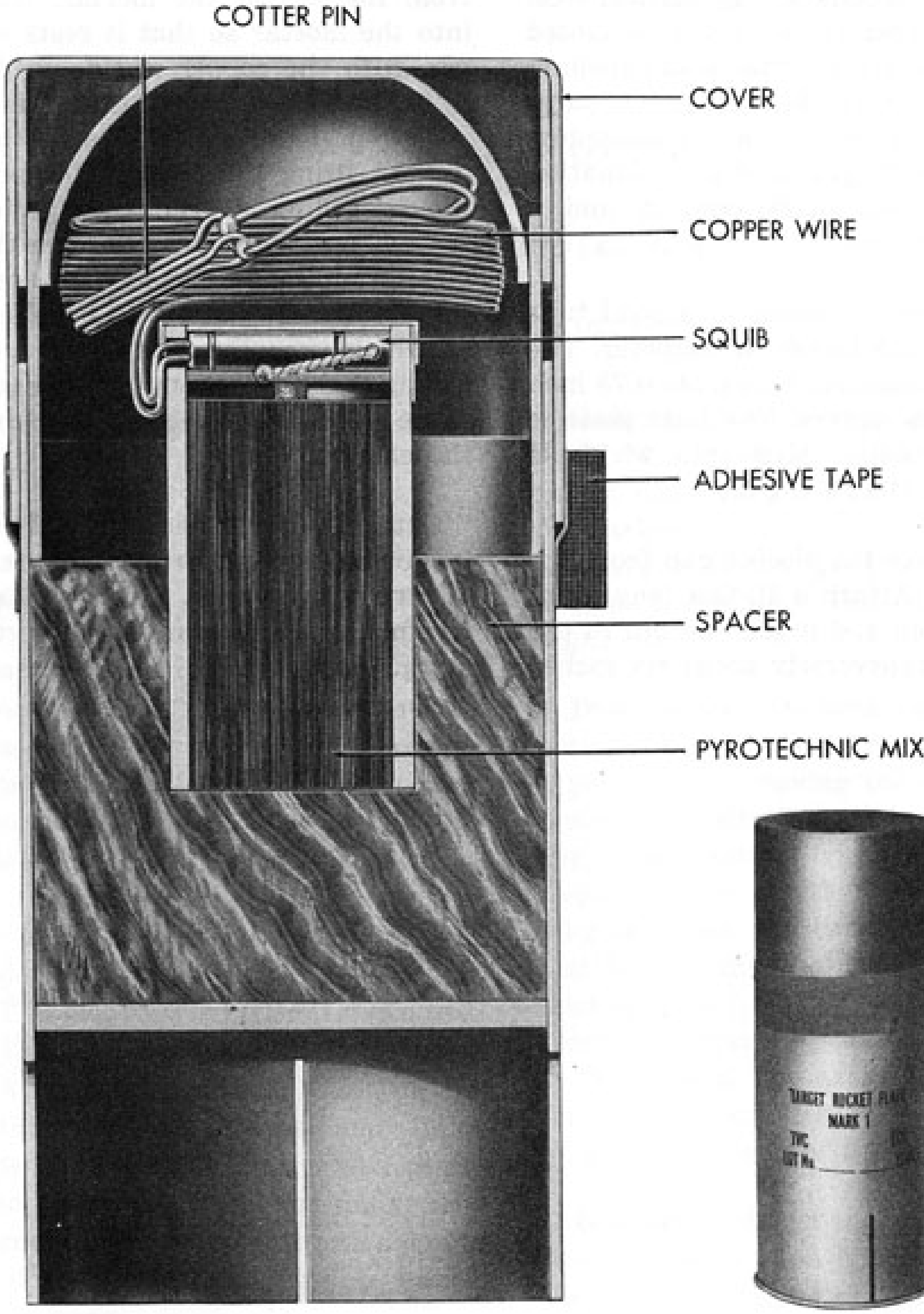
Operation: The flare may be initiated by the use of the electric squib or by pull on the release fork which allows the spring-loaded firing pin to strike the primer. The primer acts directly to ignite the first fire compsition.

Remarks: Airport Flare M76 is not procured by the Navy.

High-Altitude Parachute Mortar-Fired Flare Mk 20 Mod 0

Length, inches 10.75
Diameter, inches 2.5
Weight, pounds 5
Height of trajectory, feet 1,000
Intensity, candlepower 85,000
Color .... White
Burning time, seconds 60
Rate of fall after ignition, ft./sec. 16

Use: This high-altitude flare is used to illuminate seaplane landing areas at night, and to illuminate an island base when low ceilings do not permit proper visibility from normal flying levels.



Sectional View *Full View*

Figure 207. Target Rocket Flare Mk 1 Mod 0

Flare: The flare consists of a cylindrical steel tube body with a copper cup welded to the closed end of the tube. The body contains an expelling charge, a pyrotechnic candle, and a silk parachute. The copper cup contains a fuse assembly, a propelling charge, 25 grams of a combination smokeless powder and black powder, and a standard shotgun primer.

Mortar: The mortar consists of a steel tube 36 inches long and 2.8 inches in diameter. The tube is screwed into a steel base plate 0.75 inch thick and 12 inches square. The base plate is provided with a central stud into which is pressed a hardened steel firing pin.

Operation: Remove the closing cap from the end of the mortar. Attach a 30-foot lanyard to the brass release pin and insert the pin in the two holes drilled transversely about six inches from the end of the mortar. Insert the flare into the mortar so that it rests on the release pin, with the copper end down. Fire the flare by pulling the lanyard, thus removing the release pin. The flare falls to the bottom of the mortar, firing the primer. The primer sets off the propelling charge and ignites the delay fuse. The expanding gases force the copper cup away from the flare and fill the bore of the mortar. The flare is propelled 1,000 feet into the air, at which time the delay fuse ignites the expelling charge. The pyrotechnic candle and parachute are expelled, the expelling charge igniting the candle.

Remarks: A suitable barrier should be erected to shield personnel firing the flare. In case of a misfire, wait at least three minutes before disassembling the mortar. Clean mortar tube after firing.

SHIPBOARD PYROTECHNICS

Section I — SURFACE VESSEL ITEMS

Distress Smoke Hand Signal AN–Mk 1 Mods 0 and 1

Length, inches 3.875
Diameter, inches 1,625
Weight, pound 0.37

Description: The signal is encased in a metal cylindrical body, one end of which is closed by a soldered cap and pull ring. The case can be held comfortably and safely in the bare hand during the burning period. The signal contains a pyrotechnic smoke mixture and is watertight.

Operation: The sealing tape around the end of the cylinder is torn off and the paper cap is removed. The pull ring is brought down over the rim of the can and pressed down, using the ring as a lever to break the seal. The cylinder is pointed away from the face; and a quick pull is exerted on the pull ring, which comes out of the can, thereby igniting the smoke mixture. The signal should be held at arm's length at an angle of about 30°, so that drippings will not fall on the hand.

Remarks: This signal is to replace the White Smoke Grenade, H.C., AN–M8, for emergency kits in life rafts and aircraft.

Signal, Distress—Day and Night—Mk 13 Mod 0

Length, inches 5.12
Diameter, inches 1.62
Weight, ounces 6.4

General: Adapted for both day and night use, Hand Signal Mk 13 contains both the orange smoke canister for daylight and a flare pellet for darkness. Like the Smoke Signal AN–Mk 1 in appearance and operation, the Signal Mk 13 is small and is easily stowed in life-vest pockets, flight suits, or life rafts.

Description: The metal outer case is closed at both ends by a soldered cap to which is attached a pull ring. Removing the soldered cap pulls a brass wire attached to its bottom through a cup coated with a friction igniting compound. Depending on whether the "day" or "night" ring is pulled, the two ends of the case being distinctly so marked, the smoke mixture or the flare is ignited. Smoke emission time is approximately 18 seconds; flare burning time is 18 to 20 seconds. The average candlepower of the flare is 3,000 candles. Paper cups cover the pull rings on each end of the signal.

Operation: After the paper cup is removed from desired end, a quick pull is given on the ring. If the soldered cap fails to come off, bring the pull ring down over the side of the can, and use the ring as a lever to break the seal. Hold the signal at arm's length and 30° elevation while burning. After one end is used, the signal should be doused in water to cool the metal parts. It should then be retained for possible use of the other end. Each end is insulated and waterproofed from the other.

Remarks: Both ends of the Signal Mk 13 should never be ignited at the same time.

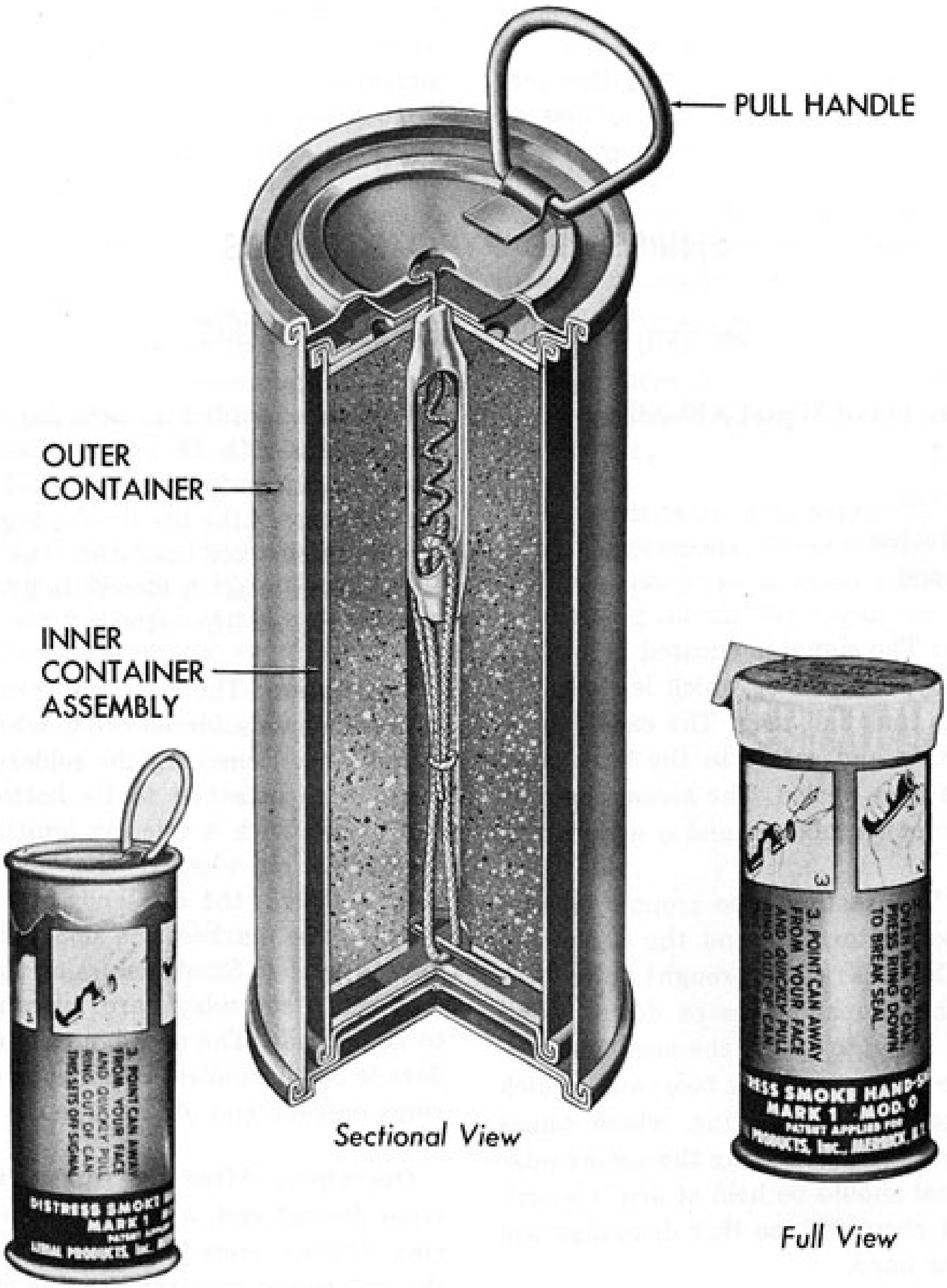


Figure 208. Distress Smoke Hand Signal AN–Mk 1 Type

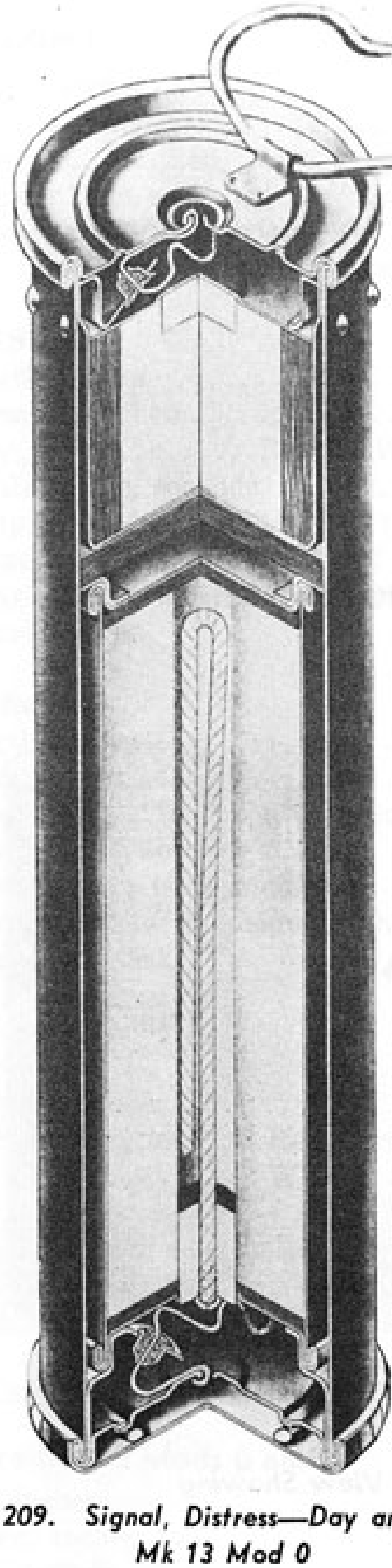


Figure 209. Signal, Distress—Day and Night—Mk 13 Mod 0

Navy Red Light Mk I and Navy Blue Light Mk I Mod I

Length, inches	12.0
Diameter, inches	1.25
Burning time, minutes	Blue—1 to 1.5
	Red—2.5 to 3

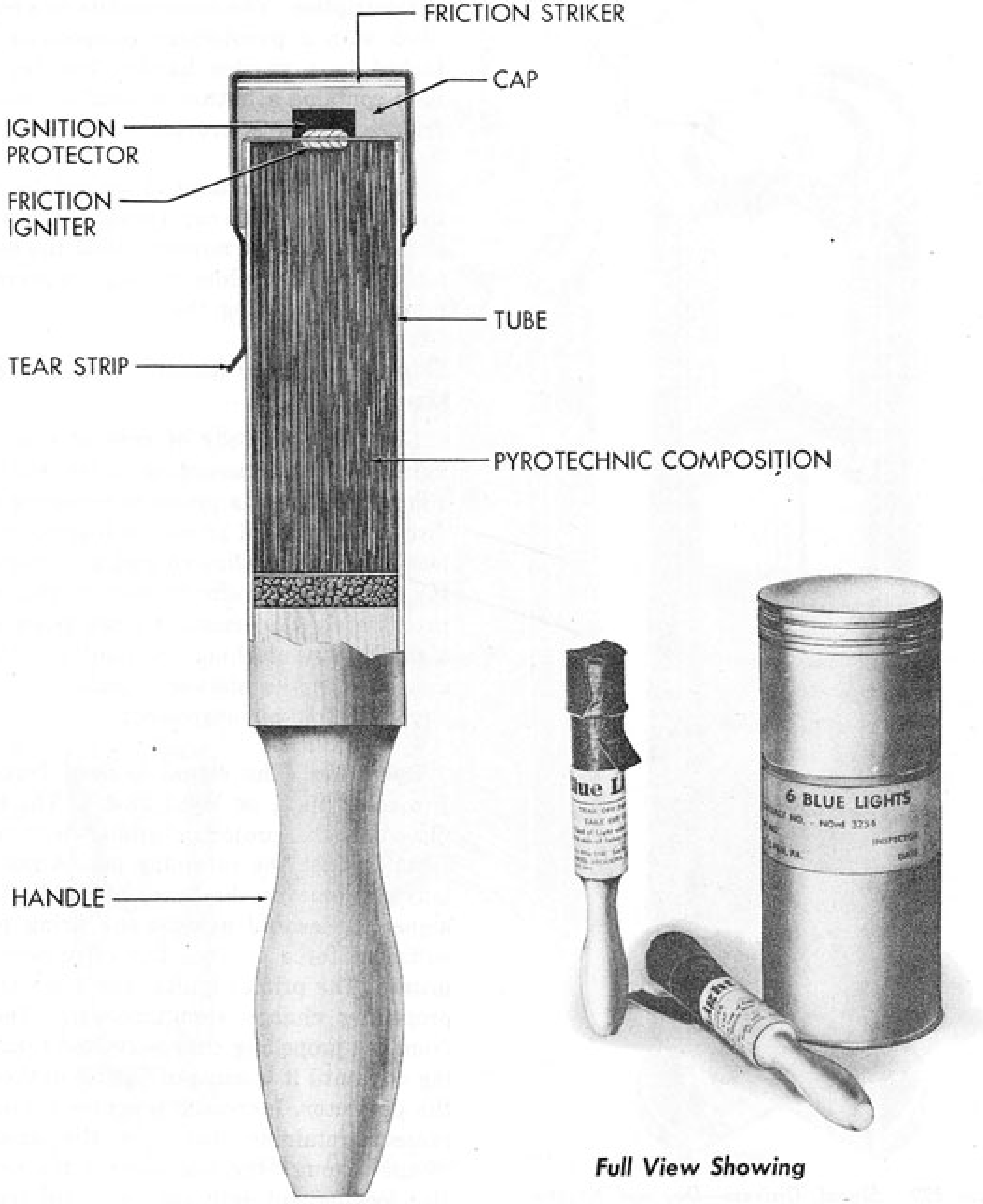
Description: The flare consists of a paper tube filled with a pyrotechnic composition and attached to a wooden handle. The top of each flare contains a button of ignition material. A friction striker is provided with each signal.

Operation: The flare is ignited by scraping the top of the inside cap against the forward end of the pyrotechnic mixture. Hold the flare in an inclined position while burning, to prevent drippings from burning the hand.

Ship's Emergency Identification Signals Mks I—4

General: The body of each of these signals varies in length according to its design. Each signal consists of a pressure-retaining disc and disc-locking nut, a primer, a four-gram smokeless-powder propelling charge, a copper obturating cup, a delay train, an ejection charge of approximately 1.1 grams of black powder, and a signal of pyrotechnic composition. All signal cups except the shower signals have a parachute for mid-air suspension.

Operation: The signal is fired from Signal Projector Mk 1 or Mk 1 Mod 1. The signal is placed in the projector primer-first, where it rests against the retaining pin. A pull on the lanyard removes the firing pin and allows the signal to descend against the firing pin with sufficient force to close the valve and fire the primer. The primer ignites the delay train and propelling charge simultaneously. The gases from the propelling charge expand the obturating cup until it is secured tightly in the bore of the projector. Increased pressure ruptures the pressure-retaining disc, and the gases then escape through the openings in the retaining-disc locking nut into the projector bore. The gases propel the signal approximately 600 feet. The ignited delay train burns until the signal reaches approximately the zenith of its trajectory, and then ignites the ejection charge. The ejection charge ejects and ignites the signal pyrotechnics through a quick match and first fire composition.



Full View Showing

Sectional View

Figure 210. ***Navy Red Light and Navy Blue Light***

Mk 1 (Star)

Length, inches 5.124
Diameter, inches 2.49
Color . . . . Red, white, green, or yellow
Burning time, seconds . . . . 25±5

The closing cup is embossed for night identification. The star is parachute-suspended.

Mk 2 (Shower)

Length, inches 6.374
Diameter, inches 2.50
Color . . . . Red, white, or green
Burning time, seconds 5

This signal is designed to give two distinct bursts, one with a short delay and one with a long delay. The closing cup is embossed for night identification.

Mk 3 (Smoke)

Length, inches 9.124
Diameter, inches 2.49
Color . . . . Red, black, green, or yellow
Burning time, seconds . . . . 25±5

The closing cap is painted with same color that is produced by the signal. The signal is parachute suspended.

Mk 4 (Chameleon)

Length, inches 5.124
Diameter, inches 2.49
Color combinations . . . . Red—green—white
White—red—green
Green—white—red
Burning time of each color, seconds 9
Delay between colors, second 1

The signal is parachute-suspended and designed to change color while burning. Otherwise, the signal is similar to the Signal Mk 1.

Float Flare Mk 15 Mods 0 and 1

Length, inches 37.2
Diameter, inches 6.5
Weight, pounds 26
Burning time, minutes 5
Intensity, candlepower 100,000
Delay before ignition, minutes 5

Use: Float Flare Mk 15 Type is used by PT boats in illuminating enemy ships.

Description: The flare consists of a wooden body housing a pyrotechnic column and having a metallic base to provide flotation stability. The top of the flare is closed by a cone-shaped adapter which contains a bouchon grenade-firing mechanism attached to a celluloid disc. Enclosed is a 3.5-foot length of time fuse. The starter composition is attached to the flash end of the time fuse. The illuminant composition is next to the starter composition.

Operation: The flare is held horizontally, with the right hand firmly grasping the bouchon lever and the left hand supporting the nose cap. The safety key is pulled and the flare is tossed overboard. When the bouchon lever is released, the firing pin is forced by the firing-pin spring to impinge upon the primer. The primer ignites the time fuse. The time fuse flashes into a booster bag of starter composition, which, in turn, ignites the flare.

Remarks: It is recommended that one man hold the flare while a second man pulls the safety ring.

Mod 1 is like the Mod 0, except that it has a mechanical clockwork timing device—for settings from one to 30 minutes—instead of the time-fuse device.

Rocket, White, Marine Type, Mk 1 Mod 0

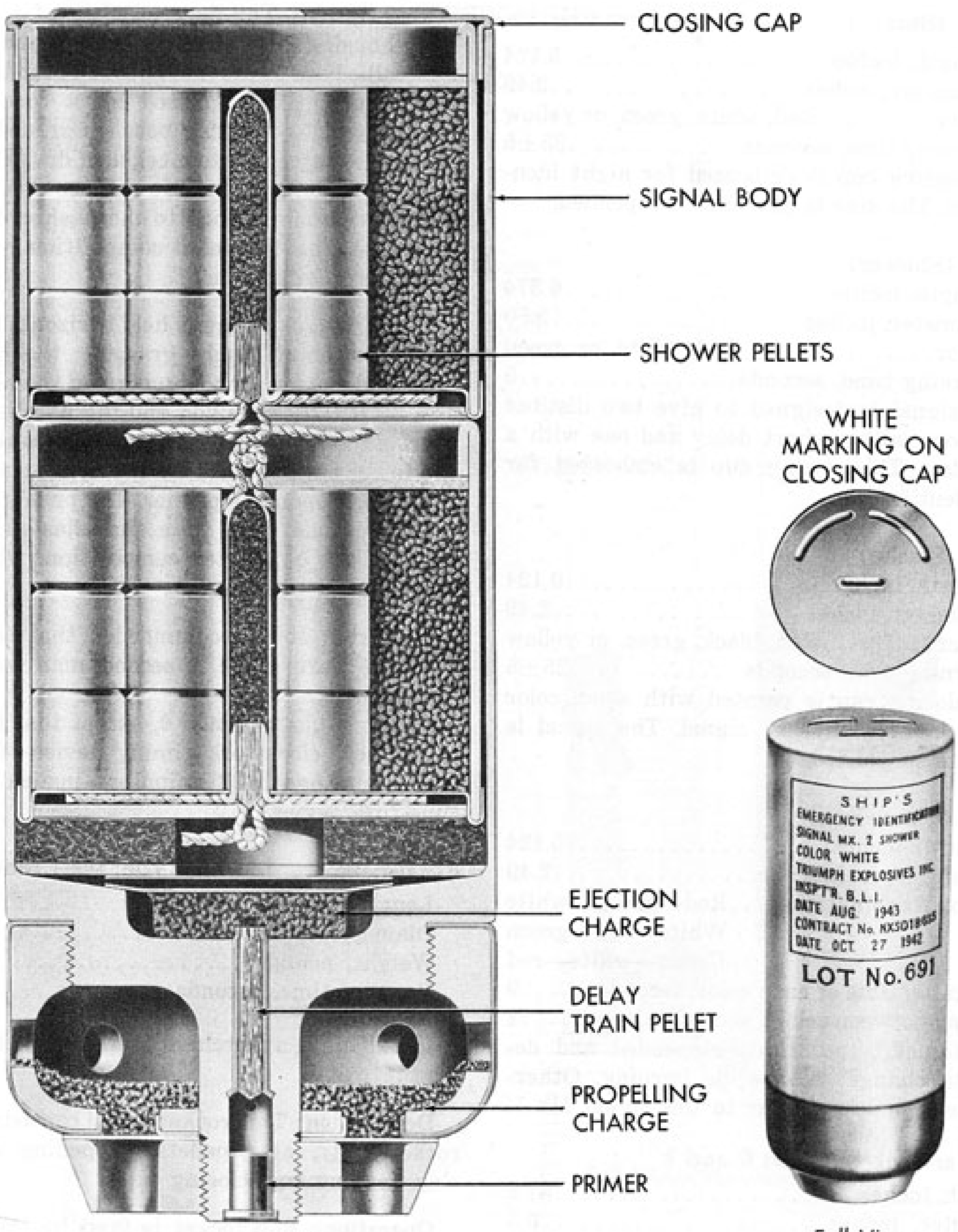
Length, inches 12.0
Diameter, inches 1.5
Weight, pounds 2
Burning time, seconds 5

Use: This is a merchant marine rocket issued by the Navy.

Description: This rocket signal consists of the rocket body, star pellets, propelling charge, clay heading, and closing cap.

Operation: The rocket is fired by the Pyrotechnic Pistol AN–M8 and reaches a height of 250 feet. At the height of its trajectory, the rocket bursts. The falling particles burn for five seconds.

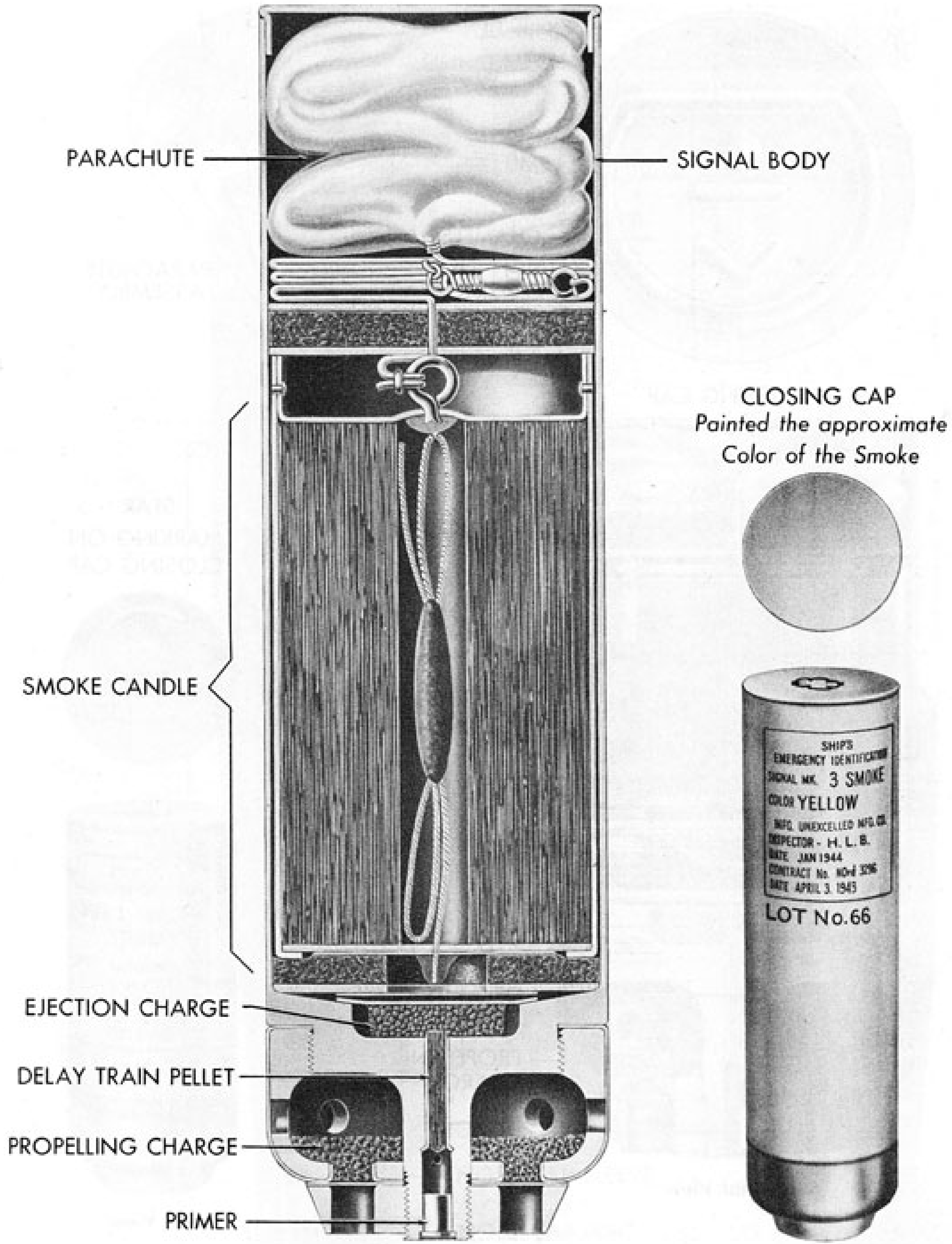
Remarks: This signal will be replaced by the Rocket Pistol Signal Mk 3 Mod 0 (Shower).



Sectional View

Full View

Figure 211. Ship's Emergency Identification Signal Mk 2 (Shower)



Sectional View

Full View

Figure 212. Ship's Emergency Identification Signal Mk 3 (Smoke)

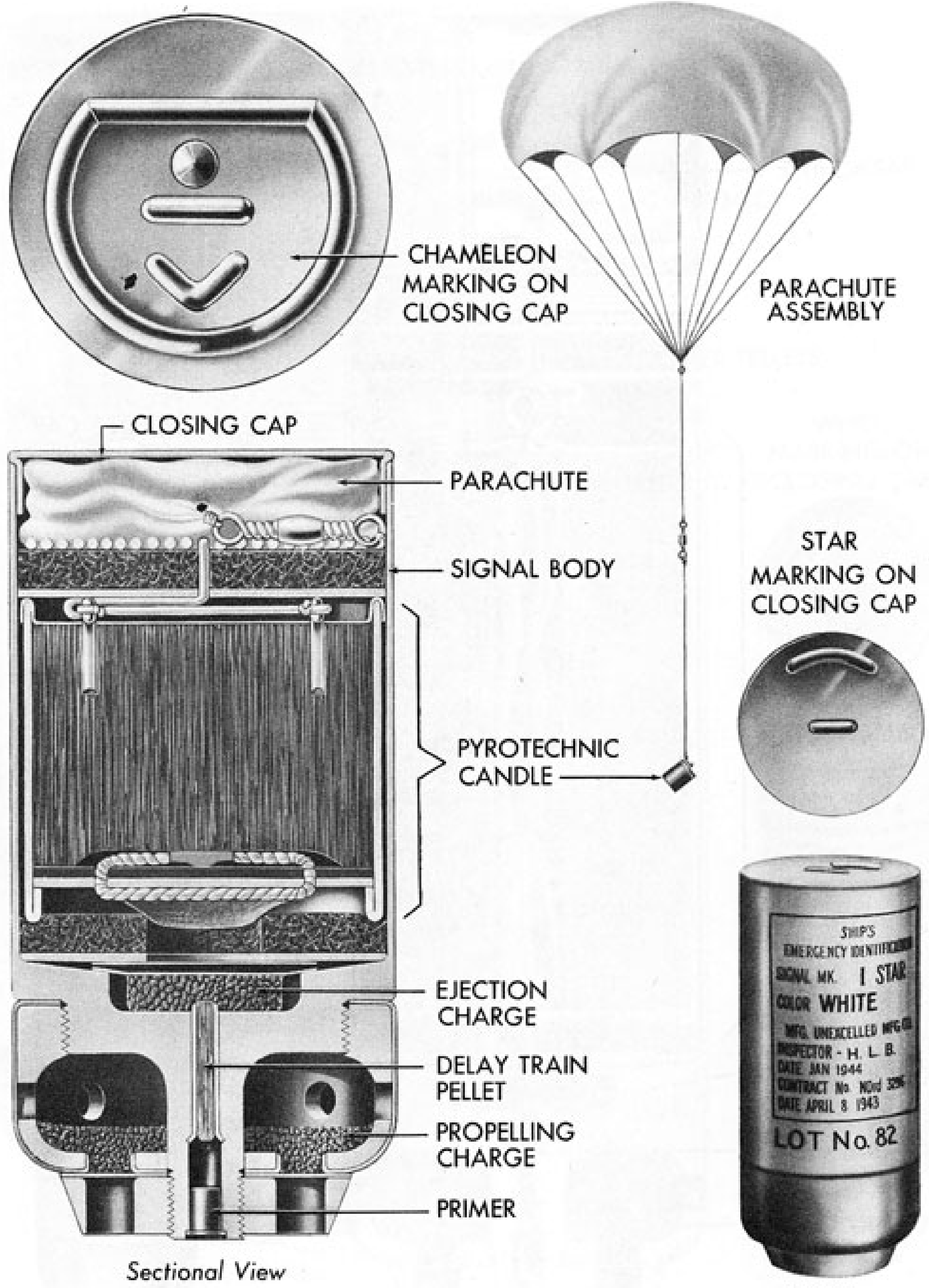
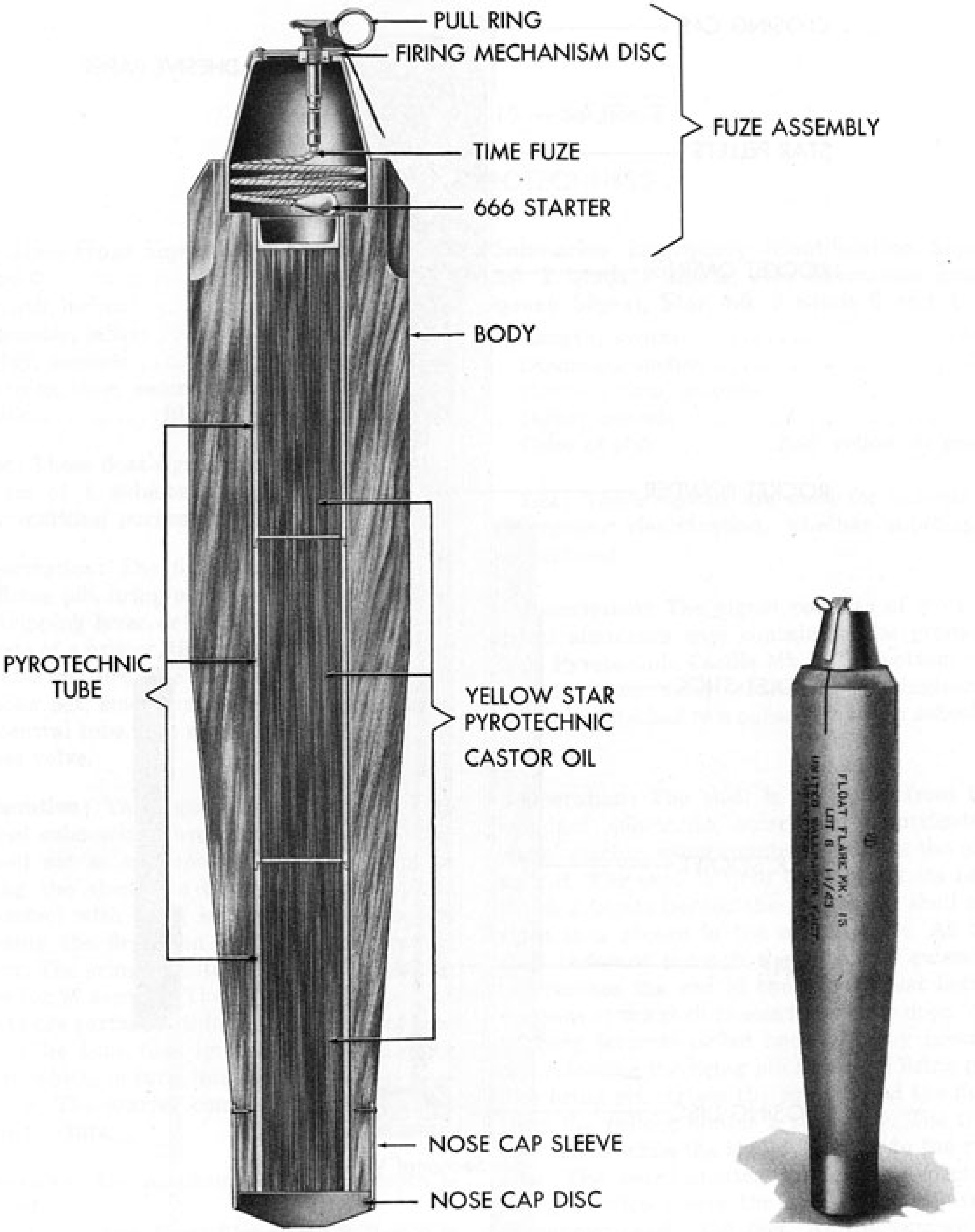


Figure 213. Ship's Emergency Identification Signal Mk 4 (Chameleon) and Signal Mk 1 (Star)



Sectional View *Full View*

Figure 214. Float Flare Mk 15 Type

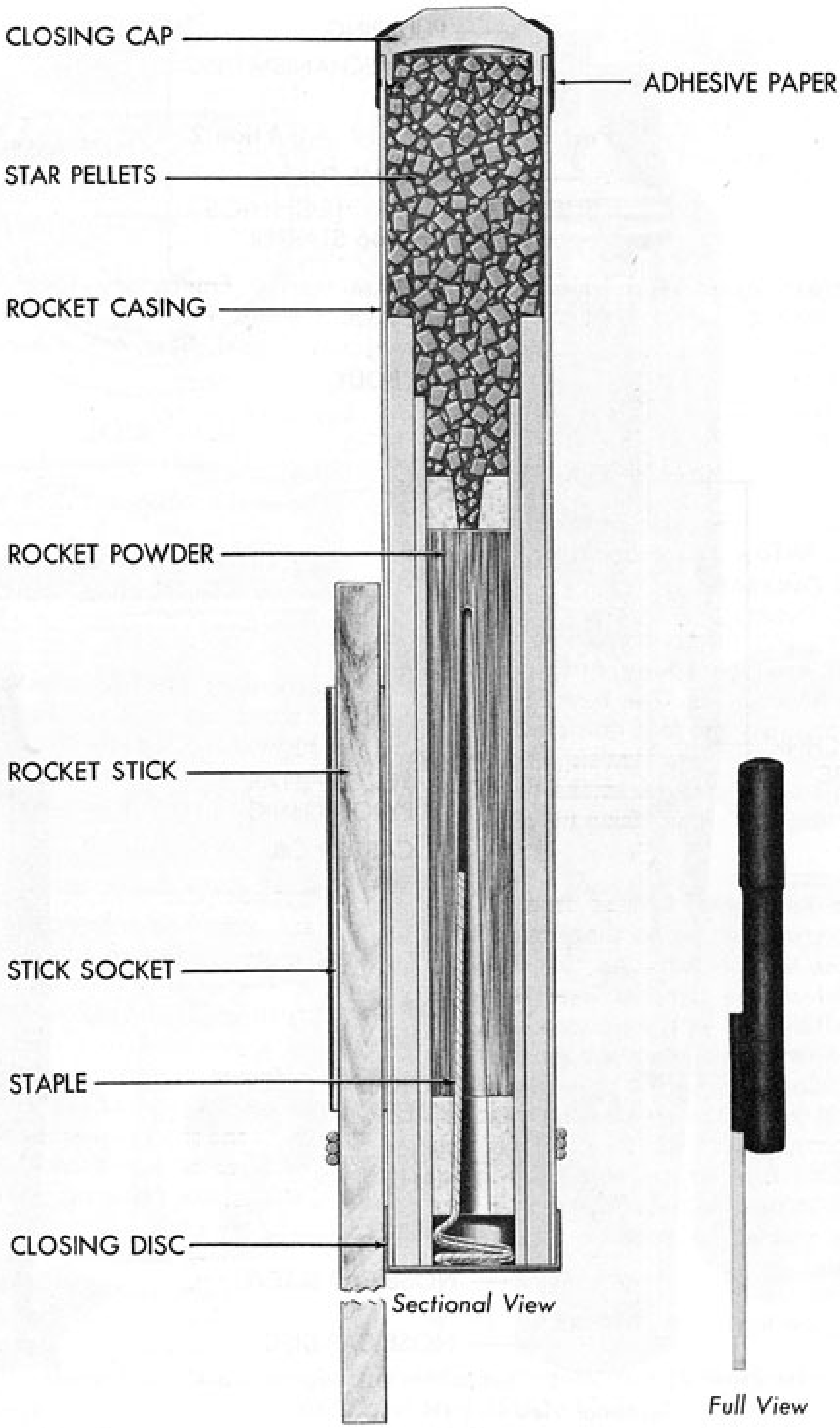


Figure 215. Rocket, White, Marine Type, Mk 1 Mod 0

SUBMARINE PYROTECHNICS

Submarine Float Signal Mk 1 Mod 1 and Mk 2 Mod 0

Length, inches	18.75
Diameter, inches	3.0
Delay, seconds	27
Burning time, seconds	15
Color	Black, yellow, green, or red

Use: These float signals are used to mark the position of a submerged submarine, and for other marking purposes.

Description: The firing mechanism consists of a firing pin, firing-pin spring, firing-pin lever, and tripping lever or lug. The ignition system consists of a primer, time fuse, quick match, and a starter mixture. The aluminum signal contains a smoke pot, smoke mixture, smoke pot-cover, and central tube. The signal has a nose cap and release valve.

Operation: The signal is fired from a submerged submarine, through a tube, using compressed air as a propellant. As the signal is leaving the ejector, a tripping lever is raised by contact with a lug in the gun, cocking and releasing the firing-pin lever, which fires the primer. The primer ignites the time fuse, which burns for 27 seconds. The signal is buoyant and rises to the surface within the 27 seconds of fuse delay. The time fuse ignites a piece of quick match, which, in turn, initiates the starter composition. The starter composition sets off the smoke mixture.

Remarks: The maximum launching depth is 162 feet.

The Submarine Float Signal Mk 2 Mod 0 is similar to the Mk 1 Mod 1, except for a fixed delay of 54 to 59 seconds, a maximum launching depth of 285 feet, and sturdier construction.

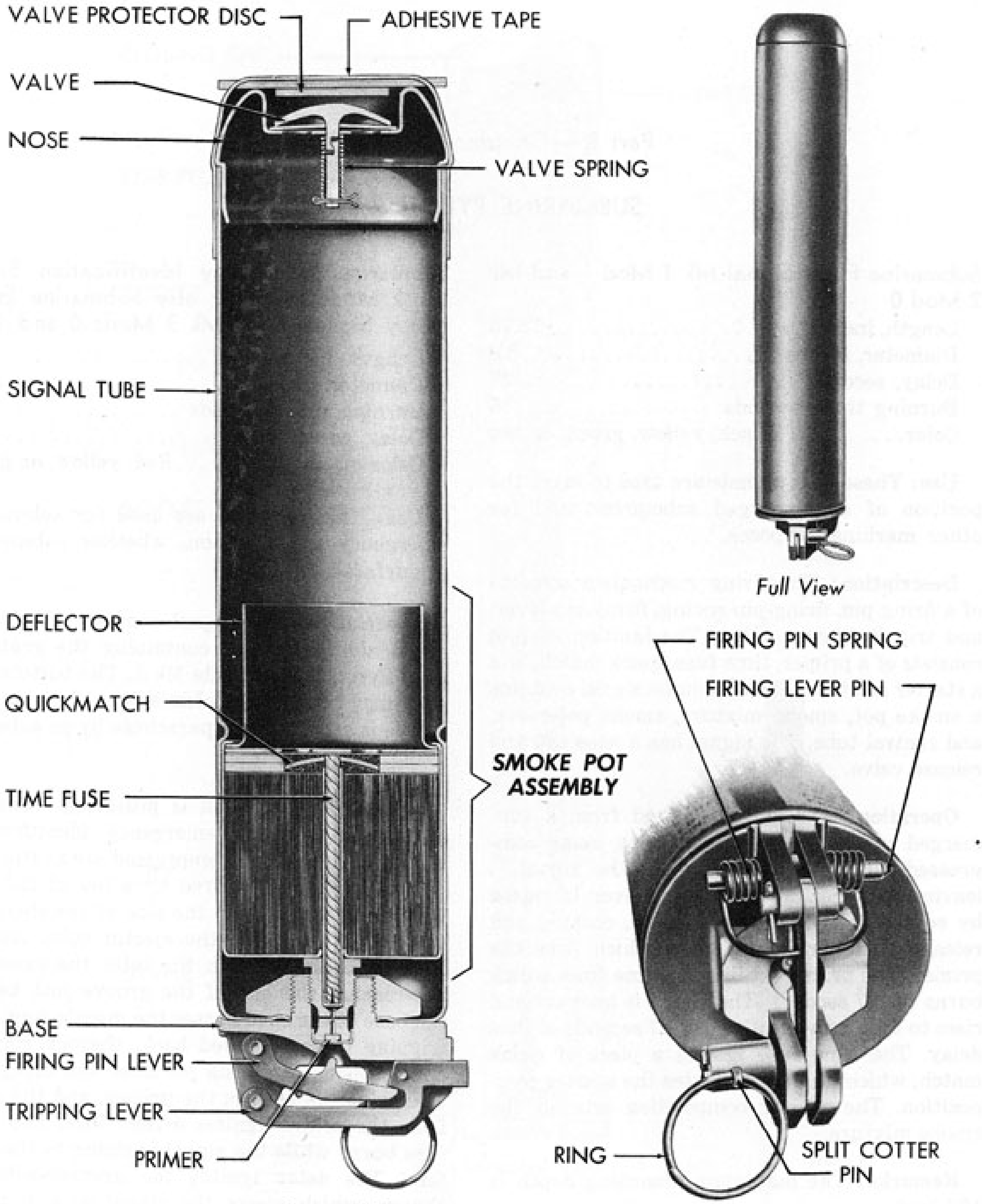
Submarine Emergency Identification Signal Mk 2 Mods 1 and 2; also Submarine Emergency Signal, Star, Mk 3 Mods 0 and 1

Length, inches	18.0
Diameter, inches	3.0
Burning time, seconds	25
Delay, seconds	27
Color of star	Red, yellow, or green

Use: These signals are used for submarine emergency identification, whether submerged or surfaced.

Description: The signal consists of a cylindrical aluminum case containing the grenade-type Pyrotechnic Candle Mk 3. The bottom end contains two delay elements. A single-star candle is attached to a parachute by an asbestos cord.

Operation: The shell is projected from the standard submarine emergency identification signal ejector, using compressed air as the propellant. The shell is fired by a lug at its base which projects beyond the side of the shell and rides in a groove in the ejector tube. As the shell is forced through the tube, the extended lug reaches the end of the groove just before the base of the shell passes the muzzle door. The tripping lever is pulled back, thereby cocking and releasing the firing pin lever and firing pin. The firing pin strikes the primer, and the flash from the primer ignites a time fuse. The time fuse burns while the signal is rising to the surface. The delay ignites the grenade-ejection charge, which ejects the signal to a distance of approximately 250 feet. At the summit of the trajectory, the delay train flashes into the signal-ejection charge and causes the parachute-suspended star to be ejected.



Sectional View

Bottom View

Figure 216. Submarine Float Signal Mk 1 Mod 1

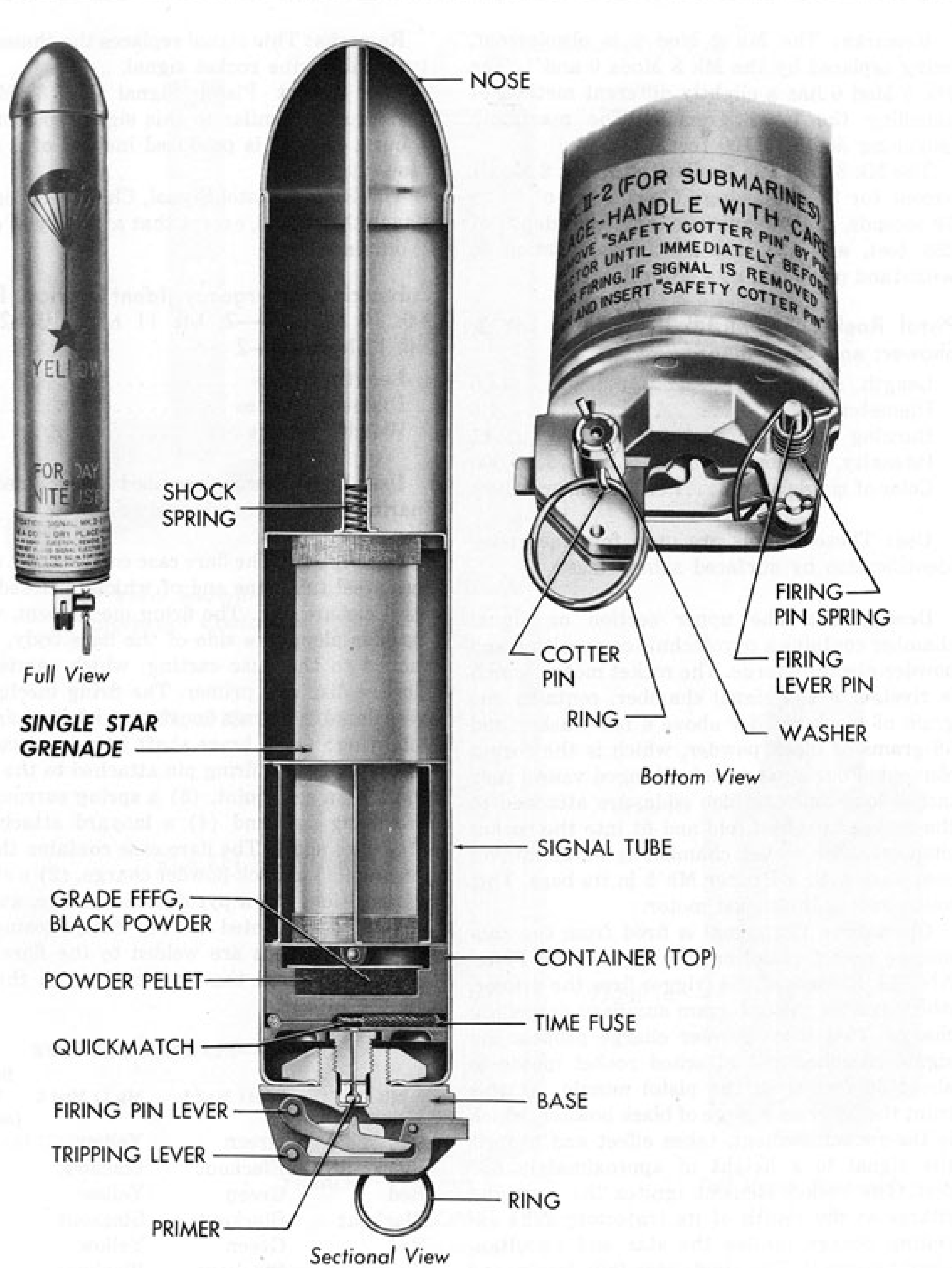


Figure 217. Submarine Emergency Identification Signal Mk 2 Mod 2

Remarks: The Mk 2 Mod 2 is obsolescent, being replaced by the Mk 3 Mods 0 and 1. The Mk 3 Mod 0 has a slightly different method of expelling the inner grenade. The maximum launching depth is 160 feet.

The Mk 3 Mod 1 is similar to the Mk 2 Mod 1 except for the following: (1) a delay of 54 to 59 seconds, (2) a maximum launching depth of 285 feet, and (3) a sturdier construction to withstand pressures at a lower depth.

Pistol Rocket Signal Mk 1, Comet; Mk 3, Shower; and Chameleon

Length, inches	14.0
Diameter, inches	1.5
Burning time, seconds	11
Intensity, candlepower	60,000
Color of single star	Red, green, or yellow

Use: These signals are used for emergency identification by surfaced submarines.

Description: The upper section or signal chamber contains a pyrotechnic composition and powder-ejector charge. The rocket motor, which is riveted to the signal chamber, contains one gram of black powder above a felt washer and 58 grams of black powder, which is the rocket element. Four spring-loaded hinged vanes, four inches long and one inch wide, are attached to the rocket tube and fold and fit into the rocket chamber. The rocket chamber is an aluminum container with a Primer Mk 5 in its base. This unit receives the rocket motor.

Operation: The signal is fired from the submarine rocket pistol or the Pyrotechnic Pistol AN–M8. Release of the trigger fires the primer, which ignites the one-gram auxiliary propelling charge. This black-powder charge propels the signal chamber and attached rocket motor to about 30 feet from the pistol muzzle. At this point the 58-gram charge of black powder, which is the rocket element, takes effect and propels the signal to a height of approximately 650 feet. The rocket element ignites the expelling charge at the zenith of its trajectory. The expelling charge ignites the star and simultaneously ejects it. The single star falls freely, and burns out just before hitting the water.

Remarks: This signal replaces the chameleon-type submarine rocket signal.

The Rocket Pistol Signal Mk 3 Mod 0 (Shower) is similar to this signal, except that a burst shower is produced instead of a single star.

The Rocket Pistol Signal, Chameleon, is similar to this signal, except that a variety of colors is obtained.

Submarine Emergency Identification Flares Mk 10 Mods 0—2, Mk 11 Mods 0—2, and Mk 12 Mods 0—2

Length, inches	9.75
Diameter, inches	2.00
Weight, pounds	3.2

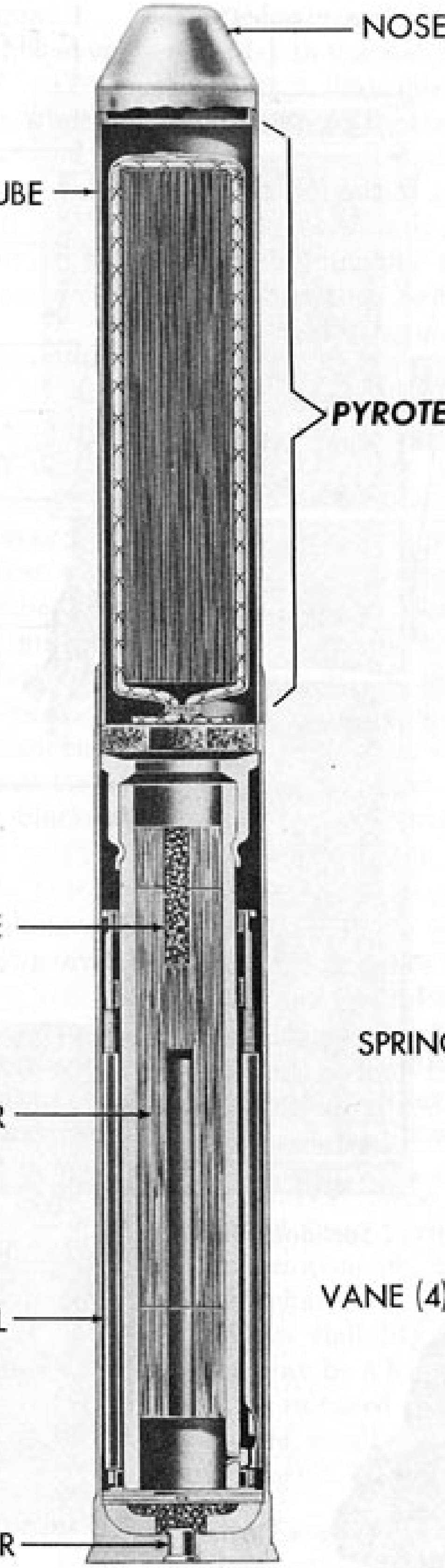
Use: These signals are used by surfaced submarines to identify themselves.

Description: The flare case consists of a seamless steel tube, one end of which is closed by a steel closure disc. The firing mechanism, which extends along the side of the flare body, is attached to the base casting, which carries the closure disc and primer. The firing mechanism is enclosed in a brass housing which contains the following: (1) a brass shaft held in place by a cotter pin, (2) a firing pin attached to the brass shaft by a sear joint, (3) a spring surrounding the firing pin, and (4) a lanyard attached to the brass shaft. The flare case contains the following: (1) a black-powder charge, (2) a starter composition, (3) a pyrotechnic charge, and (4) a steel cup riveted to the case, closing one end. Two clamps are welded to the flare body for mounting on the bracket fixed to the submarine bridge.

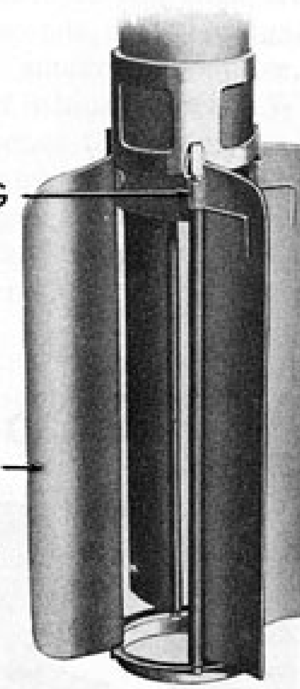
COLORS—FLARES MK 11 TYPE

Mk 11	Mk 11 Mod 1	Mk 11 Mod 2	Burning Time (seconds)
Red	Green	Yellow	10
Blackout	Blackout	Blackout	5
Red	Green	Yellow	10
Blackout	Blackout	Blackout	5
Red	Green	Yellow	10
Blackout	Blackout	Blackout	5
Red	Green	Yellow	10

Full View Showing Waterproof Container



COMET TYPE
Sectional View



Tail Vane Assembly
Full View

Figure 218. Pistol Rocket Signal Mk 1, Comet

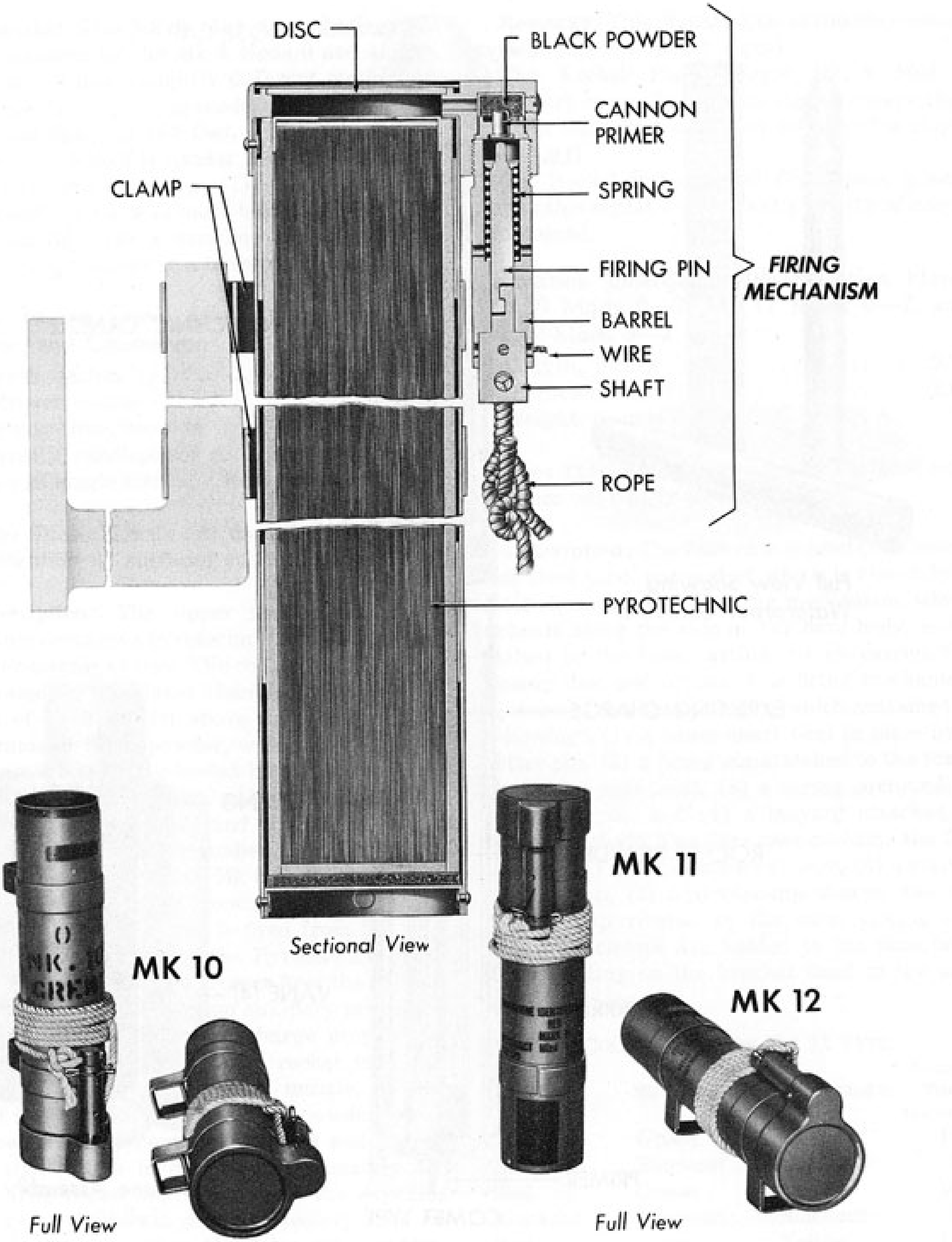


Figure 219. Submarine Identification Flares Mks 10, 11, and 12 Type

COLORS—FLARES MK 12 TYPE

Mk 12	Mk 12 Mod 1	Mk 12 Mod 2	Burning Time (seconds)
Red	Red	Green	10
Blackout	Blackout	Blackout	5
Green	Yellow	Yellow	10
Blackout	Blackout	Blackout	5
Red	Red	Green	10
Blackout	Blackout	Blackout	5
Green	Yellow	Yellow	10

Operation: Mount the flare so that the firing mechanism points toward the deck. A vertical pull on the lanyard forces the brass shaft up, compressing the firing-pin spring. The sear joint between the shaft and firing pin is broken when the shaft is pulled approximately 0.5 inches. The firing pin strikes the primer, which ignites a small charge of black powder. The flash from the black powder ignites the starter composition, which, in turn, ignites the pyrotechnic candle. The flare burns in four increments of 10 seconds duration and intervening blackout increments of five seconds.

Remarks: Flares that have been submerged below periscope depth should be thrown overboard at the first opportunity.

The possibility of detonation in any of the flares, and particularly in those with green pyrotechnics, should never be lost sight of. For this reason, personnel in the vicinity of the flares should be adequately shielded prior to firing.

Submarine Emergency Identification Flares Mk 10 and Mods are similar to the Flares Mk 11 and Mods and Mk 12 and Mods, except that these burn with only one uninterrupted color—Mod 0, red; Mod 1, green; and Mod 2, yellow.

False Target Shell Mk 1 Mod 0

Length, inches 18.0
Diameter, inches 3.0
Delay, seconds 27
Persistence of echo, minutes .... 4 to 18

Use: This shell is used to confuse and disrupt enemy underwater echo ranging.

Description: The external appearance is similar to the Submarine Emergency Signal Mk 2 Mod 2. The shell holds six metal cups 2.75 inches in diameter and 1.875 inches in depth, filled with a lithium hydride paraffin mixture. The base of the shell contains a primer, time fuse and 20-gram charge of smokeless powder. Attached to the base is a firing mechanism which is used with the standard emergency identification signal ejector.

Operation: The shell is projected from the standard emergency identification signal ejector, using 200 pounds per square inch air pressure if possible. The shell is fired by a lug at its base which projects beyond the side of the shell and rides in a groove in the ejection tube. As the shell is forced through the tube, the extended lug reaches the end of the groove just before the base of the shell passes the muzzle door. The tripping lever is pulled back, thereby cocking and releasing the firing pin lever and firing pin. The firing pin strikes the primer, and the flash from the primer ignites a length of time fuse coiled in the base of the shell. The time fuse burns for 27 seconds, and then ignites the 20-gram charge of smokeless powder, which ejects the six cups of lithium hydride. When the lithium hydride touches the water, a chemical reaction occurs which yields fine hydrogen bubbles. The hydrogen bubbles return an echo of the same order and magnitude as that returned by a submarine.

Remarks: False target shells should be segregated from pyrotechnics and other ammunition components, and should be kept in a dry atmosphere.

When visibility is such that surface disturbance may be a hazard, false target shells should not be released from depths less than 150 feet, because small bubbles or a surfaced canister may result.

False Target Can Mk 2 Mod 0

Length, inches 19.3
Diameter, inches 3.0

Use: False Target Can Mk 2 Mod 0 has the same use as False Target Shell Mk 1 Mod 0.

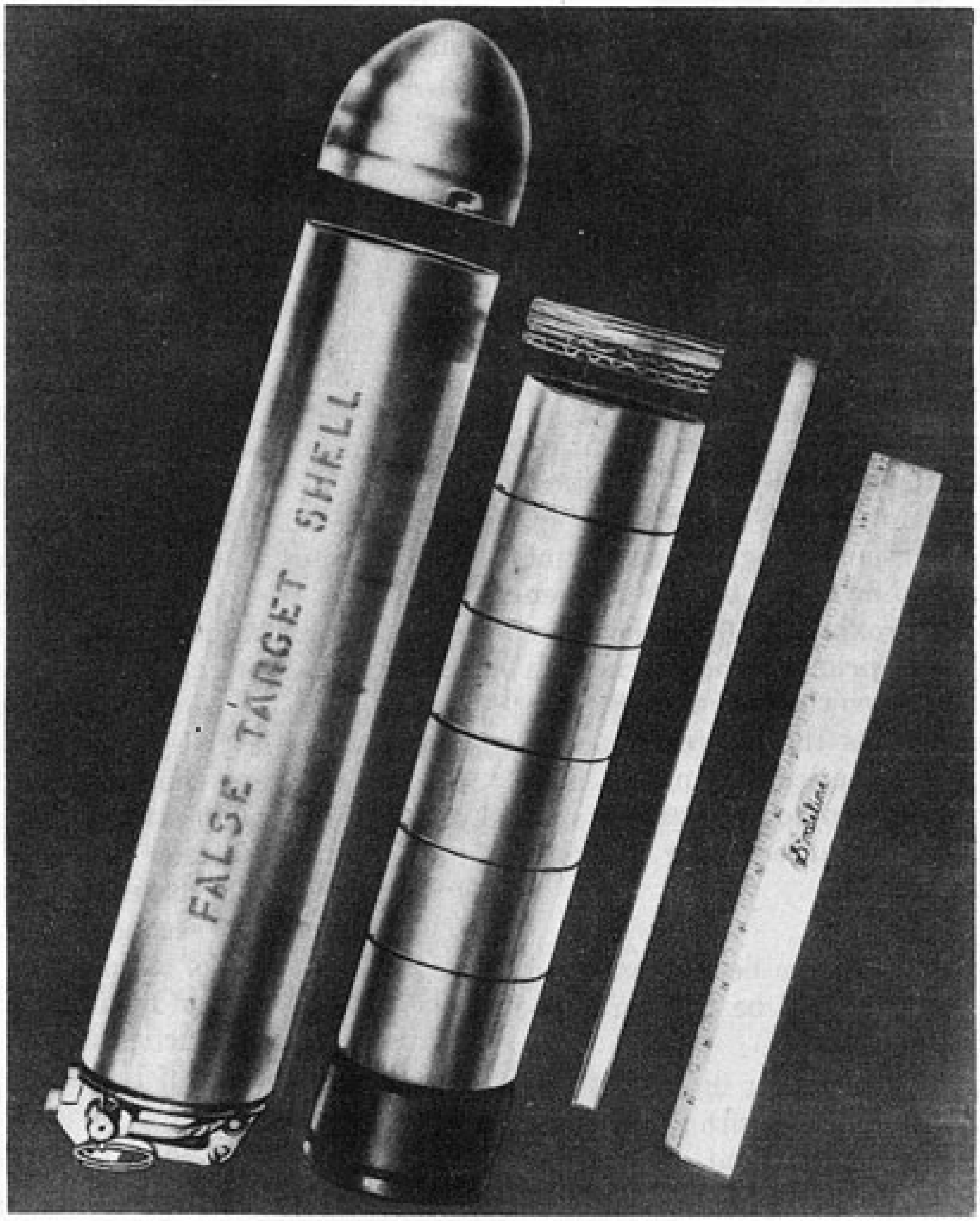


Figure 220. False Target Shell Mk 1 Mod 0

Description: Generally similar to the False Target Shell Mk 1 Mod 0, this can is a tube of sheet steel sealed at both ends, containing nine metal cups filled with a lithium hydride composition. These cups can be released individually at any desired rate when used with the new hydraulic-type air-operated signal ejector. The cups are separated by aluminum discs, and a one-inch metal spacer separates the end caps of the outer tube from the top and bottom inner cups. Tear strips are provided at either end to open the can.

Operation: The tear strips, the end caps, the spacers on either end, and the corrugated paper disc at the top end are removed, with the can in a horizontal position to prevent dropping one of the cups. Insert one end into the breech of the ejector about one inch. Put a rammer in the other end of the can and push the cups toward the muzzle of the ejector, until the spring detent near the top of the barrel drops behind the last cup. Remove the empty tube. Place the firing valve on "Vent". Close the breech door and flood the barrel from the sea through the flood line,

allowing air to escape through the vent line. When no air escapes the vent or firing valve, close these valves and open the muzzle door. Make the pressure in the volume tank 50 pounds greater than sea pressure, and throw the firing valve into the "Fire" position.

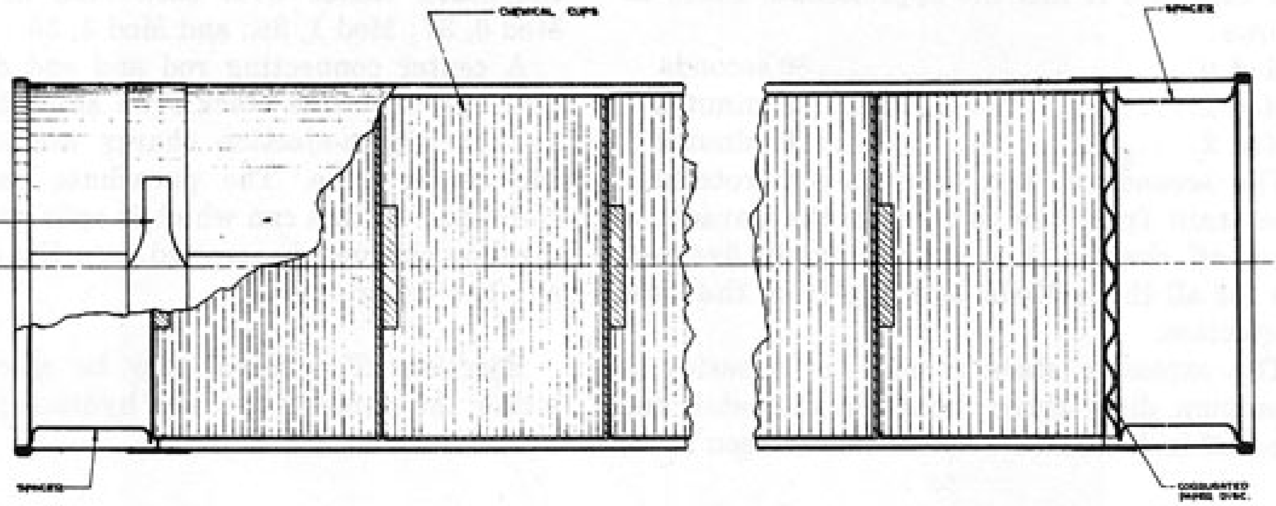


Figure 221. False Target Can Mk 2 Mod 0

Signal (Pepper) Mk 14 Mods 0—2 (Production suspended)

Length, inches	27.5
Diameter, inches	3.0
Weight, pounds	19 (approx.)

General: The Signal (Pepper) Mk 14 is an expendable explosive noisemaker for underwater use. It consists of a series of aluminum discs, each of which has sixteen small explosive charges around its periphery. Each disc contains a gasless fuse train which ignites the charges at one-half second intervals and then communicates the ignition to the succeeding discs. Approximately five minutes of noise can be produced. Parachute suspension is used to retard the sinking rate. A firing device ignites two delay-fuse trains. The initial delay train ignites the first of the explosive discs, and the secondary delay train fires a small black-powder charge which ejects the parachute. The Signal (Pepper) Mk 14 is supplied as Mods 0, 1, and 2, having 30-second, 2-minute, and 6-minute initial delays respectively. Mods 0, 1, and 2 are identical, except that one explosive disc in Mod 1, and two in Mod 2, have been replaced by initial time-delay discs. The effective firing time is the same in all three Mods, for practical consideration.

Tests on the initial production of this device show that about 75% of the units may be expected to operate to completion. It is recommended that, wherever possible, two or more units be fired in quick succession to insure functioning.

Description: The signal consists of the following components: firing device, initial time delay, secondary time delay, a stack of explosive-loaded discs, a center connecting tube and end discs to support the explosive stack, parachute knock-off charge, parachute assembly, and packing container.

The firing device is identical in operation to the firing device used on the Submarine Emergency Identification Signals. It consists of a support, firing lever, tripping lever, safety pin, and safety cotter pin. When the safety cotter pin is pulled, it allows the safety pin to be forced back by its spring, releasing the tripping lever. On ejection, the tripping lever is forced back by the end of the tripping groove. The tripping lever lifts the firing lever against the firing

spring and then releases it to fire the primer. The primer ignites both the initial and the secondary time delays.

The initial time delay is a pyrotechnic fuse train from the primer to the first of the explosive capsules. It has the approximate times as follows:

Mod 0 .... 30 seconds
Mod 1 .... 2 minutes
Mod 2 .... 6 minutes

The secondary time delay is a pyrotechnic fuse train from the primer to the parachute knock-off charge. It is approximately five secons for all three Mods, starting from the time of ejection.

The explosive stack consists of a series of aluminum discs three inches in diameter and one-half inch thick. Each disc has sixteen small explosive-loaded capsules inserted radially around the periphery. The capsules are connected by an internal ring fuze train which is timed to fire the charges at the rate of two shots per second. The number of explosive discs in the stack varies with each Mod as follows: Mod 0, 37; Mod 1, 36; and Mod 3, 35.

A center connecting rod and end discs support the explosive stack. The secondary delay and parachute-ejection charge are located in the center tube. The parachute assembly—chute packed in a can which is split open by the ejection charge—is screwed onto the end opposite the firing device.

Ejection: The signal may be ejected from either the hand or the new hydraulic air-operated ejector at any depth.

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GRENADES

Chapter 11 — HAND GRENADES

General

The design of hand grenades has been confined by several limiting technicalities, as follows: the grenade must be small and light; its range is short; there is no set-back or creep force of significance in the throwing operation; and the grenade must be rugged and safe enough to be carried on the bodies of troops.

Hence, despite the many tactical purposes—anti-tank, anti-personnel, screening, etc.—hand grenades are generally of the same shape, size, and fuze action.

Fragmentation Mk II, Mk IIA1; also Fuze M204

Over-all length, inches	4.5
Diameter, inches	2.25
Color	Olive drab
Weight, pounds	1.40
Filling	Flaked and granular TNT
Weight of filling, ounces	1.75

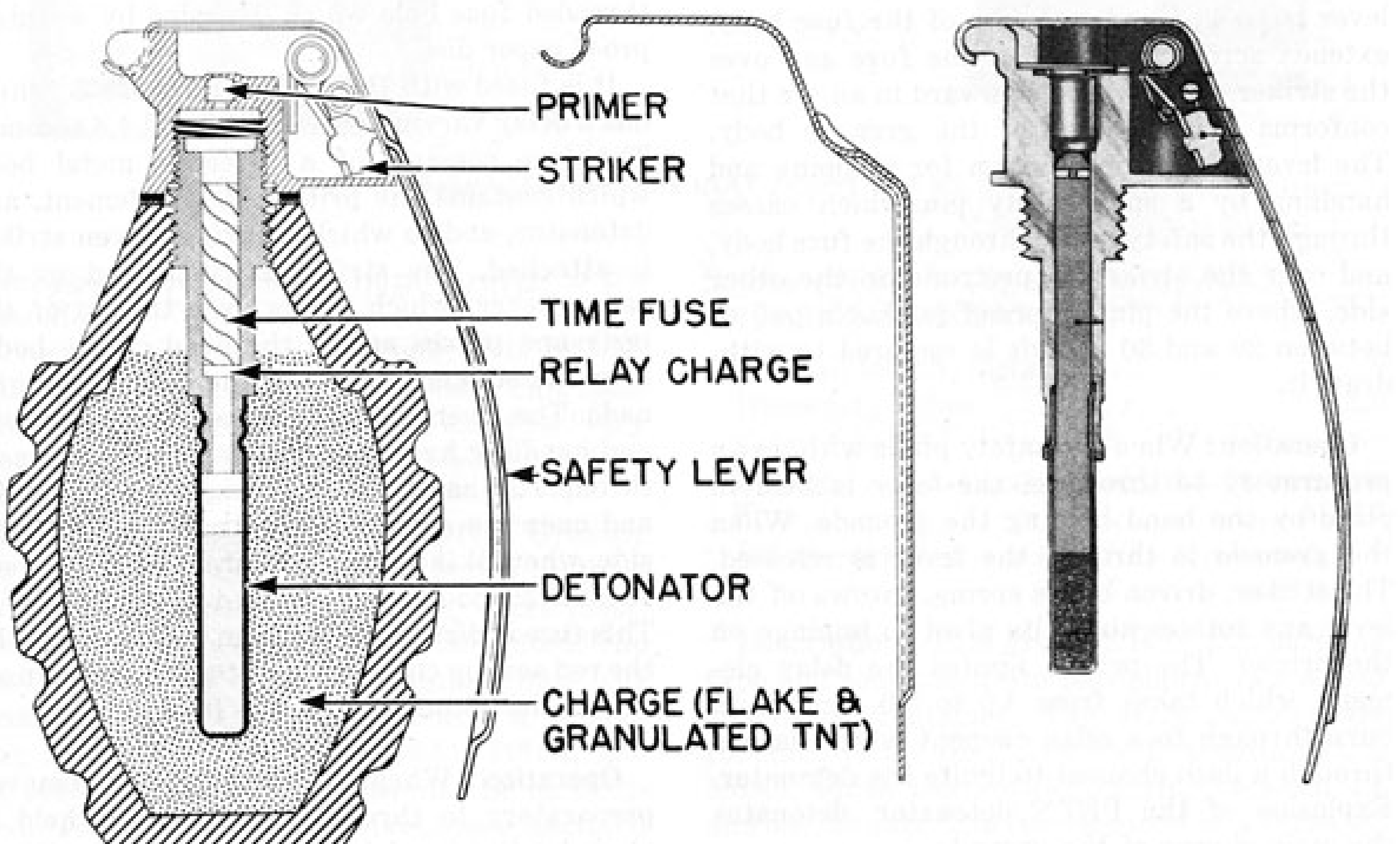


Figure 222. Fragmentation Grenade Mk II with Fuze M204 in place (At right is the Fuze M10A3, issued with an earlier model.)

Fuze	M204
Delay, seconds	4.0 to 5.0

Description: The Fragmentation Grenade Mk II has a serrated cast-iron body of the familiar "pineapple" design. The grooves run both horizontally and vertically to assist in the formation of uniform fragments of effective size.

This grenade is issued loaded and fuzed with Igniting Fuze M204. This Fuze M204 produces no noise other than that of the impact of the striker on the primer, and emits no smoke or sparks during its burning. The fuze consists of a body, striker, safety lever, and safety pin. The body of the fuze is cylindrical in shape and is threaded for assembly to the grenade. It contains the primer, a delay element sufficient to give an average delay of 4.5 seconds, and a detonator of PETN. At the top of the body, one side is extended and slotted to form a point of fulcrum for the attachment of the safety lever. The striker is retained by the safety lever. The lever is hooked under the lip of the fuze body, extends across the head of the fuze and over the striker, and curves downward in an arc that conforms to the shape of the grenade body. The lever is held in position for shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker to protrude on the other side, where the pin is spread so that a pull of between 20 and 30 pounds is required to withdraw it.

Operation: When the safety pin is withdrawn preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the lever and rotates about its pivot to impinge on the primer. The primer ignites the delay element, which takes from 4.0 to 5.0 seconds to burn through to a relay element which flashes through a flash channel to ignite the detonator. Explosion of the PETN detonator, detonates the main charge of the grenade.

The grenade can be thrown about 35 yards. Effective fragmentation covers an area of 30-yard radius, but fragments may travel as far as 200 yards.

Earlier models: This grenade replaces an earlier model, the Mk IIA1, which was identical to the Mk II except for the fuze and the filling, the Mk IIA1 being issued with the Fuze M10A3. The only external difference is that the safety lever fits over rather than under the lip of the fuze body. The Fragmentation Grenade Mk II is filled with ¾ ounce of E.C. powder.

Offensive Mk IIIA1 and Mk IIIA2; also Fuzes M6 and ~~M205~~ M206A1

Over-all length, inches	5.35
Diameter, inches	2.125
Color	Black
Total weight, pound	0.84
Fuze	~~M205~~ M206A1
Delay, seconds	4.5

Description: The Offensive Grenade Mk IIIA2 consists of a cylindrical pressed-fiber body and a charge of pressed TNT. The head contains a threaded fuze hole which is sealed by a waterproof paper disc.

It is fuzed with Detonating Fuze ~~M205~~ M206A1, which has a delay varying between 4.3 and 4.8 seconds. The fuze consists of a threaded metal body which contains the primer, delay element, and detonator, and to which a spring-driven striker is attached. The striker is restrained by the safety lever, which hooks over the lip of the body and passes across the head of the body, over the striker, and down the side of the grenade. The lever is held in place during shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 10 and 30 pounds is required to withdraw it. This fuze is distinguished from igniting fuzes by the red sealing compound, instead of green, used to seal the detonator into the fuze.

Operation: When the safety pin is removed preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the lever and rotates about its pivot to strike the primer. The primer ignites the delay element, which

Figure 223. Offensive Grenade Mk IIIA1 (right) and Mk IIIA2 (left)

takes about 4.5 seconds to burn through to the detonator.

The explosion of the detonator sets off the main charge, producing a blast effect. This blast is not effective against personnel except at very short ranges or in enclosed spaces.

Earlier models: The Offensive Grenade Mk IIIA1 differs from the Mk IIIA2 in that the ends of the grenade body are of sheet metal and the grenade weighs 0.875 pound fuzed. The Mk III had metal ends and contained only 0.27 pound of TNT. It was shipped with a wooden plug in the fuze well. The M6A1, M6A2, and the M6A3 models of this fuze may be encountered. These modifications have been declared unsafe for use and should be destroyed.

Remarks: The Hand Grenade Mk IIIA2 has been taken out of production, but large quantities of them still exist.

Smoke (W.P.) M15; also Fuzes M6A3, M10A3, and M200A1

Over-all length, inches	5
Diameter, inches	2.5
Color	Blue grey
Filling	White phosphorus
Fuze	M6A3
Delay, seconds	4.5

Description: This grenade is of the bursting type and contains white phosphorus in a sealed cylindrical container. The body corners are rounded. It is fuzed with the Detonating Fuze M6A3, which has a delay varying between 4.3 and 4.8 seconds. The fuze consists of a threaded metal body which contains the primer, delay element, and detonator, and to which a spring-driven striker is attached. The striker is restrained by the safety lever, which hooks over the lip of the body and passes across the head

of the body, over the striker, and down the side of the grenade. The lever is held in place during shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 10 and 30 pounds is required to withdraw it. This fuze is distinguished from igniting fuzes by the red sealing compound, instead of green, used to aid in sealing the detonator into the fuze. It differs from the Detonating Fuze M10A3 in that the safety lever is straight, while that of the M10A3 is curved. It differs from the Detonating Fuze M200A1 in that the length of the body is approximately four inches, as compared with a body length of two inches for the M200A1. The detonator consists of a seven-grain primer charge and a 13.5-grain tetryl charge.

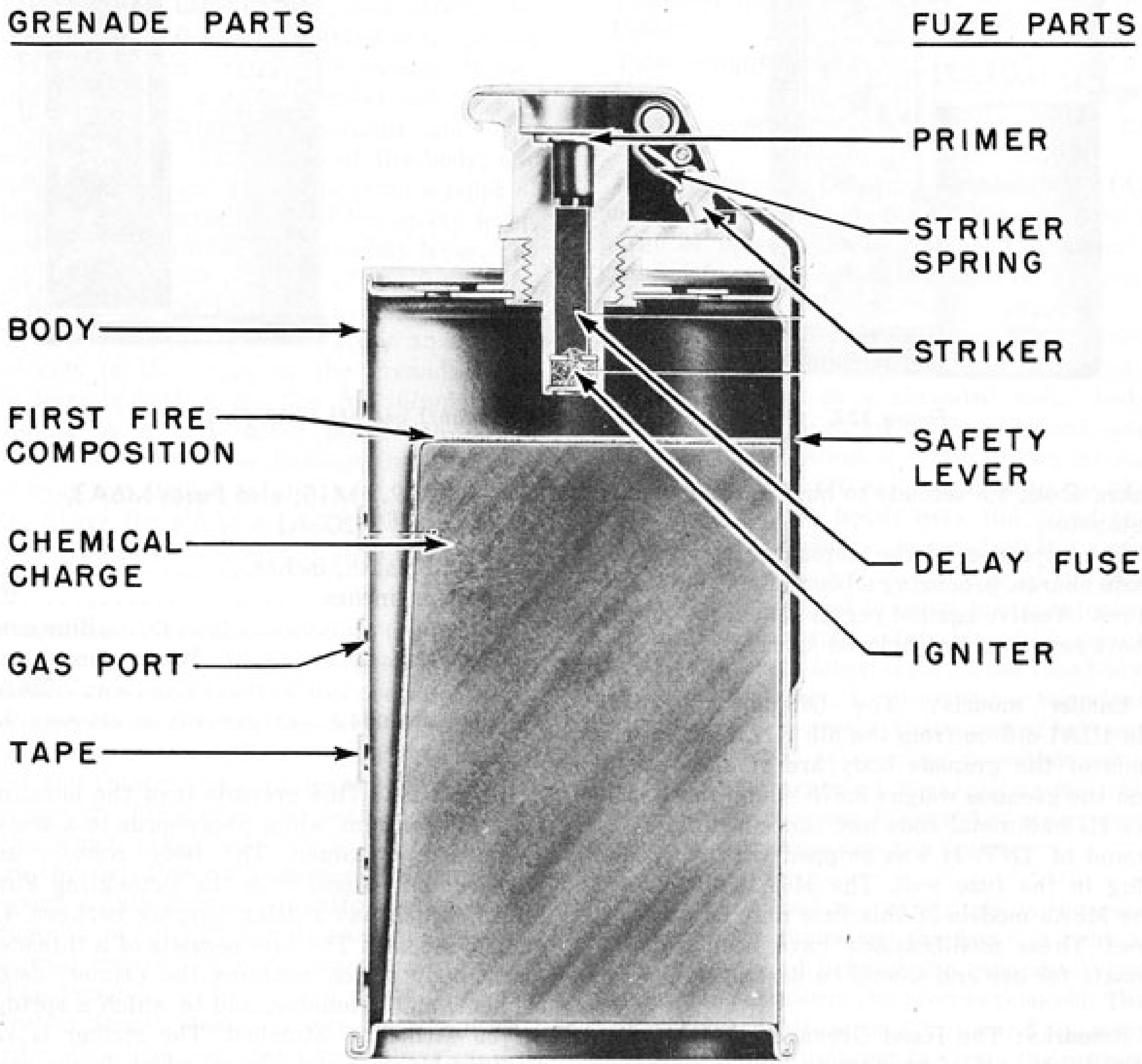


Figure 224. Chemical Grenade

Operation: When the safety pin is removed preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the lever and rotates about its pivot to strike the primer. The primer ignites the delay element, which takes about 4.5 seconds to burn through to the detonator.

When ignited by the delay element, the detonator bursts the case and scatters the phosphorus over an area about 25 yards in diameter. The phosphorus ignites spontaneously, and the scattered pieces will burn for about 30 seconds.

Gas CN–DM–M6, CN–M7, and CN–M7A1; also Fuze ~~M200A1~~ M201A1

Length, inches	5
Diameter, inches	2½
Color	Blue grey
Filling	M6—Chloracetophenone, Diphenylamine, chloraisine, burning mixture M7—Chloracetophenone, burning mixture
Fuze	M201A1 ~~M200A1~~
Delay, seconds	2

Description: These grenades are of the burning type; they do not explode. They have a cylindrical body made of tin plate. The M7A1 has a half-inch gas port in the bottom and four ports in the head, covered by small squares of adhesive tape. A center hole is placed through the CN mixture. At the top and in this hole is the starter mixture. The M6 and M7 have three lines of six gas ports in the body and four ports in the head, covered by small squares of adhesive tape.

The Fuze M201A1 ~~M200A1~~ threads into the top of these grenades. It is essentially the same as the IGNITING ~~Detonating~~ Fuze M10A3 used in the fragmentation hand grenade. However, there is only a two-second delay element, an igniter, and no detonator. This results in a fuze with a much shorter body. At the top of the body, one side is extended to form a lip for the attachment of the safety lever; the other side forms a hinge to carry the spring-loaded striker. The striker is restrained by the safety lever. The lever is hooked over the lip of the fuze body and extends across the head of the fuze, over the striker, and down the side of the grenade. The lever is held in position for shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 20 and 30 pounds is required to withdraw it.

Operation: When the safety pin is removed preparatory to throwing, the lever is held in place by the hand holding the grenade. When the grenade is thrown, the lever is released. The striker, driven by its spring, throws off the safety lever and rotates about its pivot to strike the primer. The primer ignites the delay element, which takes about two seconds to burn through to the igniter. The igniter ignites the starter mixture, which creates enough heat to vaporize the chemical ingredients. The pieces of adhesive tape covering the gas ports are blown or burned off and gas is emitted. The gas generation reaches full volume three seconds after the safety lever is released, and gas is emitted for from 20 to 60 seconds. The M7A1 has an average burning time of 45 seconds.

Remarks: The M7A1 is an improved model of the M7, which is now substitute standard. The tendency of the M7 to flame or explode upon ignition has been eliminated in the M7A1, which also produces more than double the concentration of CN smoke and vapor.

Smoke, White, H.C., AN–M8, and Colored, M18 and M16—also Fuze M201

Length, inches	5
Diameter, inches	2.5
Color	Blue grey
Filling	AN–M8—Hexachlorethane-zinc M18—Colored smoke mixture
Fuze	M201
Delay, seconds	2

Description: These grenades have four smoke ports in the head. These are covered by small squares of adhesive tape. The Grenades M18

produce seven colors of smoke: red, orange, blue, green, black, violet, and yellow. The M16 is a limited standard colored-smoke grenade and differs from the M18 in that it produces smoke for 2½ minutes, while the M18 produces smoke for one minute, and the AN–M8 produces a white smoke for three minutes.

The Fuze M201 threads into the top of these grenades. It is essentially the same as the M10A3 used in the fragmentation hand grenades. However, there is only a two-second delay element, an igniter, and no detonator. This results in a fuze with a much shorter body. At the top of the body, one side is extended to form a lip for the attachment of the safety lever; the other side forms a hinge to carry the spring-loaded striker. The striker is restrained by the safety lever. The lever is hooked over the lip of the fuze body and extends across the head of the fuze, over the striker, and down the side of the grenade. The lever is held in position for shipping and handling by a split safety pin which passes through the safety lever, through the fuze body, and over the striker, to protrude on the other side, where it is spread so that a pull of between 20 and 30 pounds is required to withdraw it.

Operation: The igniter ignites the starter mixture, which initiates the smoke mixture. The pieces of adhesive tape covering the smoke ports are blown or burned off, and smoke is emitted for approximately 3½ minutes.

The volume of smoke generated by a grenade is generally too small for screening purposes. Although these grenades may be used to patch gaps in a larger screen, the authorization is for signals.

Remarks: The presence of moisture will cause these grenades to ignite spontaneously. If a fire should occur in such munitions, an attempt should be made to remove and segregate the burning items. Neither water nor the usual chemical extinguishers should be used in an attempt to extinguish such fires.

The Smoke Grenade M16 is designated as a substitute standard item.

Smoke, Red, AN–M3; also Modified Fuze M201

Length, inches	5.5
Diameter, inches	3
Color	Blue grey
Filling	Red smoke mixture
Fuze	Modified M201
Delay, seconds	2

Description: This grenade differs from the other smoke grenades in that the body is assembled in a cylindrical outer container. This container has eight smoke-emission ports in its top. It also has three light metal flaps welded to the side, which may be bent outward at right angles to furnish bearing for supporting the grenade in snow, mud, or other soft surface. With the outer container, this grenade is slightly larger than the ordinary smoke grenade.

The Fuze M201 has been modified by shortening the safety lever so that it does not protrude down the side of the grenade. At the top of the body, one side is extended to form a lip for the attachment of the safety lever; the other side forms a hinge to carry the spring-loaded striker.

Remarks: This grenade is used for signaling, especially in snow.

Illuminating Mk I

Length, inches	4.4
Diameter, inches	2.1
Total weight, ounces	9.5
Delay, seconds	7
Burning time, seconds	25
Candlepower	50,000

Description: This grenade is approximately the same size and shape as the fragmentation hand grenade. It consists of two sheet-steel cups joined together by a force fit, and sealed with Petman cement. The lower half contains the illuminating compound and a charge of black powder, which, when ignited by the fuze, blows the grenade apart and ignites the pyrotechnic. The upper half contains the fuze assembly, which is similar in appearance and in operation to that of the fragmentation hand grenade.

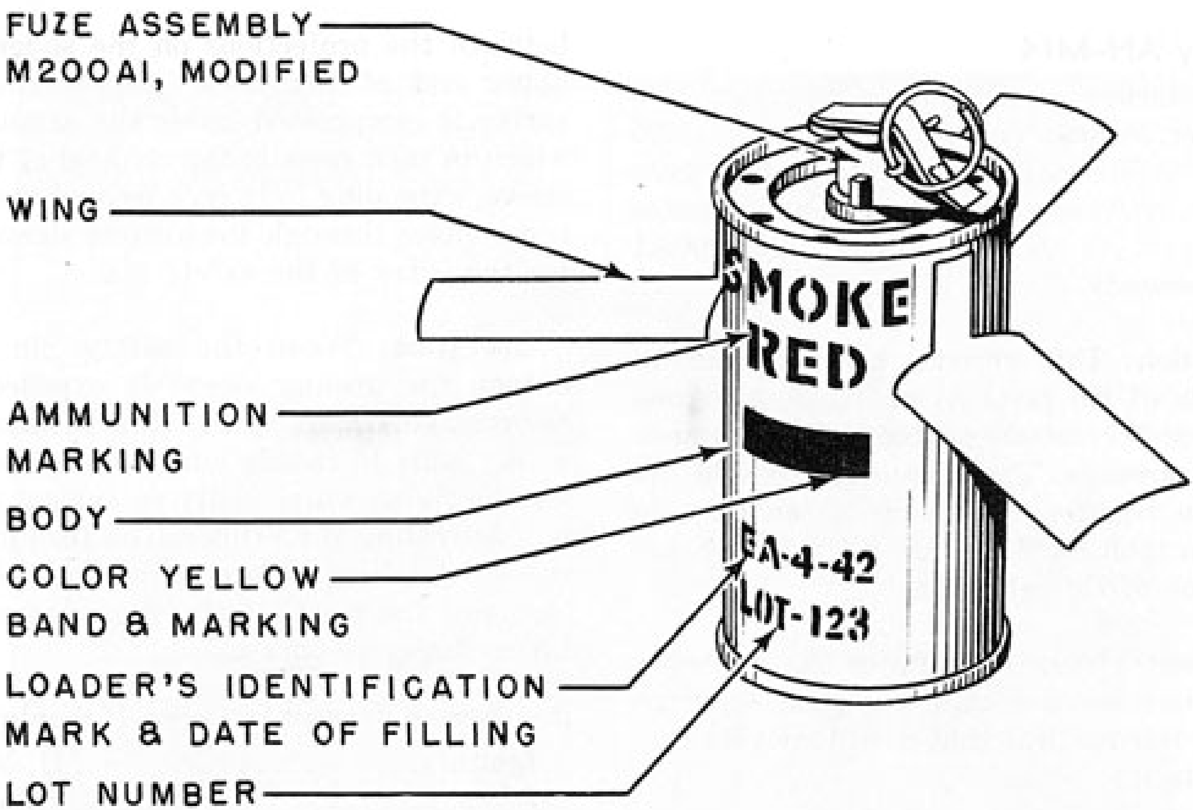


Figure 225. Red Smoke Grenade

Operation: For hand launching, the grenade is held in one hand with the safety lever against the palm. The safety pin is removed with the other hand. When the grenade is thrown, the safety lever is released, and the striker, driven by its spring, forces the lever off, swings around its pivot, and strikes the primer. The flame from the primer ignites a delay train which burns through to the charge of back powder. The black-powder charge bursts the case and ignites the pyrotechnic.

For rifle launching, assemble the grenade in the Adapter M1, insert the safety lever into the arming clip, and force the grenade into place between the claws, so that the claws engage the raised portion of the grenade where the upper and lower halves are formed together. When the grenade is fired, set-back will cause the arming clip to come off of the safety lever, and the striker will throw the lever off and hit the primer to activate the grenade.

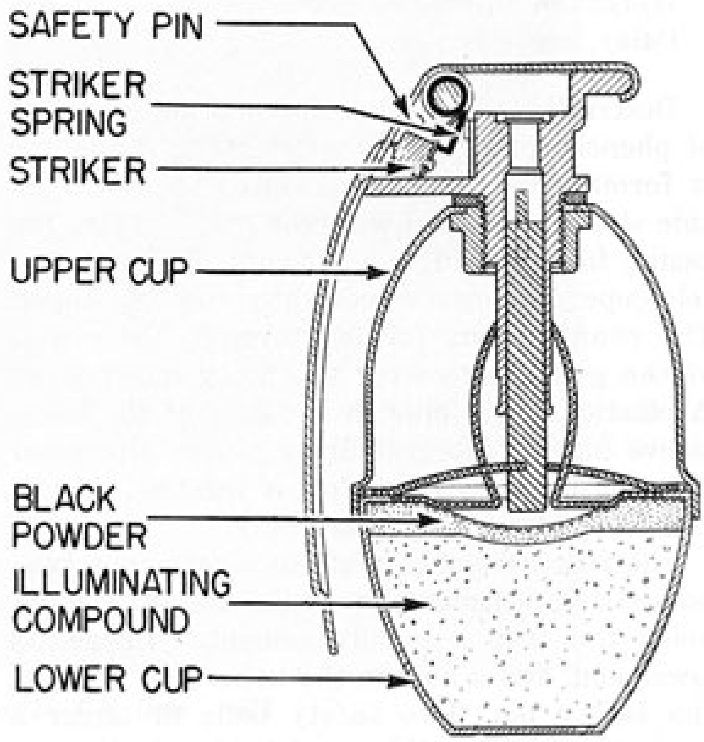


Figure 226. Illuminating Grenade Mk 1

Incendiary AN–M14

Length, inches 5
Diameter, inches 2.5
Color .... Blue grey
Filling..... Thermate, thermite, and nitrates
Fuze M2000A1
Delay, seconds.......................... 2

Description: This grenade has a cylindrical body made of tin plate. A clamp of flat steel strapping and a nail are packed in the container with each grenade. These are used to hold the grenade in position, as it has a tendency to move upon ignition. The Fuze M200A1 threads into the top of this grenade.

Operation: The igniter ignites the thermite, which ignites the thermate. The grenade burns with such intense heat that it will melt its way through steel.

Riot—CN Gas—M25

Diameter, inches 2.9
Filling .... Micropulverized chloracetophenone (CN)
Weight of filling, ounces............... 3⅓
Delay, seconds 2

Description: The Riot Grenade M25 is made of phenolic plastic. It is spherical in shape and is formed from halves cemented together. Inside sleeves, integral with the halves, form the casing for the firing components. These sleeves telescope; the lower is cemented into the upper. The channel thus formed through the center of the grenade receives the firing mechanism. A plastic closure plug in the base of the lower sleeve has an integral firing pin on the inner side. A filling closure plug is located ½ inch from the firing-pin closure plug.

The fuze assembly contains a primer, a two-second delay element, and a detonator. A slider holds the fuze assembly cemented inside its lower end, and a hole in the upper end receives the safety pin. Two safety balls fit under a projection on the slider and hold it in the unarmed position until released into the grooves when the arming sleeve is expelled. The firing spring fits over the slider and is compressed between the projections on the slider and the upper end of the lower sleeve. The arming spring is compressed inside the arming sleeve, which in turn rests in the channel of the upper sleeve, extending 5/16 inch beyond the grenade body. Holes through the arming sleeve provide for the entry of the safety pin.

Operation: When the safety pin is withdrawn, the arming sleeve is expelled by the compressed arming spring; this permits the two safety balls to recede into the grooves, releasing the slider, which is driven against the firing pin, activating the primer. The fuze provides a two-second delay before detonation. With shattering of the plastic body, the micropulverized CN is dispersed in a cloud.

Improvised frangible types (Obsolete)

Igniters..................... M1, M2, or M3
Filler................. Gasoline and alcohol
Thickened gasoline
Smoke
Hydrocyanic acid
Gasoline and napalm

Description: These are improvised grenades made by simply filling a glass bottle with one of these chemical agents. They may or may not have an igniter, depending upon the filling that is used. If the filling is smoke or hydrocyanic acid, no igniter is required; but if the filling is one of the others mentioned above, an igniter is necessary.

Igniter M1: This is a plastic cylinder containing a chemical powder. It is used with grenades containing a mixture of gasoline and alcohol. When the glass container breaks against the target, the powder and liquid come in contact and ignite spontaneously.

Igniter M2: This is a paper cartridge, filled with powder, assembled to a pull-wire igniter. This igniter is taped to a frangible grenade filled with thickened gasoline. To operate the igniter, pull the wire, lighting the powder.

Igniter M3: This is a simple fuze consisting of a spring-loaded firing pin and a blank cartridge contained in a cylinder, and a metal

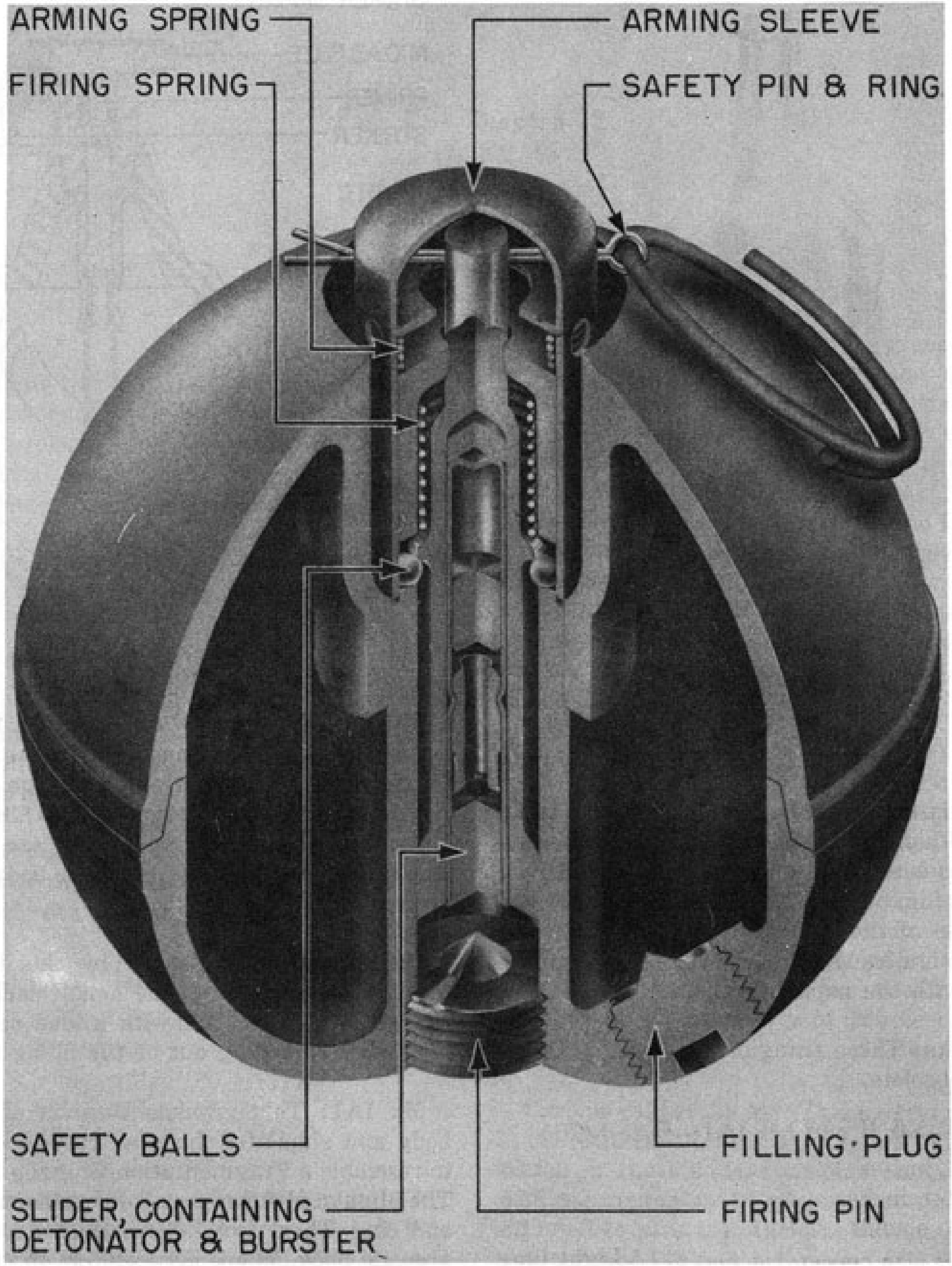


Figure 227. Riot Grenade—CN Gas—M25

clamp to hold the cylinder against the frangible grenade. The clamp has a conical projection which, when the clamp is tightened around the safety pin which passes through the cylinder, also restrains the firing pin. When the grenade is used, the safety pin is removed and the

Figure 228. *Frangible Grenade*

grenade is thrown so as to smash against the target. When the bottle breaks, the tension on the clamp is released and the firing pin, driven by its spring, pushes the cone aside and strikes the primer of the cartridge. The flash from the cartridge ignites the grenade filler. This igniter is used with the napalm grenade.

Remarks: These frangible grenades are considered obsolete.

Practice—Mk II and Mk IA1—Fuze M206

Length, inches	4.53
Diameter, inches	2.25
Weight, pounds	1.28
Color	Light blue
Fuze	M205 OR M10A3 ~~M206~~
Delay, seconds	4.0 to 4.8

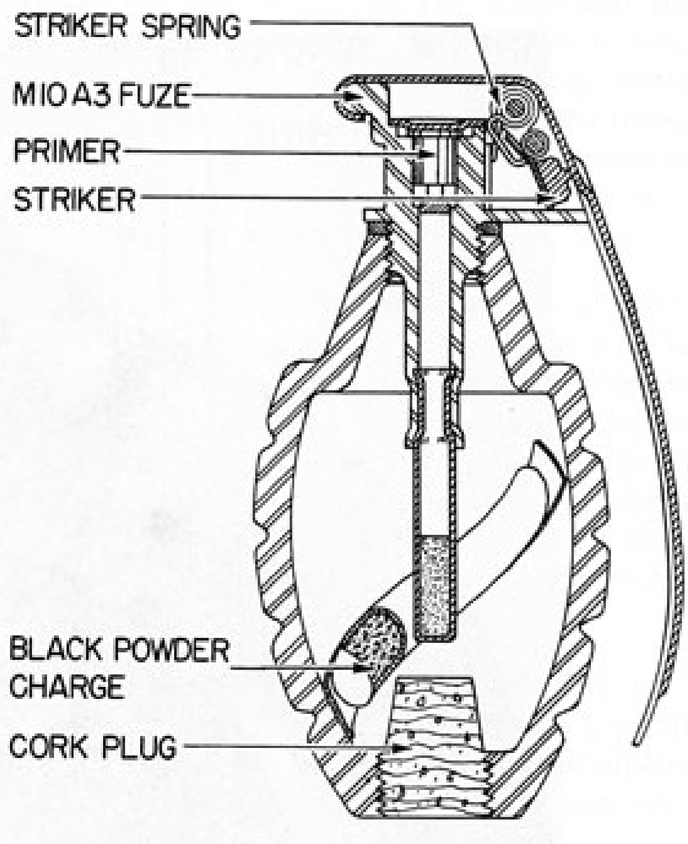


Figure 229. *Practice Grenade*

Mk II: This grenade consists of a fragmentation body with a filling hole in the base, an Igniting Fuze M205 or M10A3 ~~M206~~, a small charge of black powder, and a cork plug in the filling hole. Extra fuzes, charges, and plugs are supplied separately, so that the grenade body can be re-used.

Operation: When set off by the delay element, the igniter fires the small black-powder charge, which goes off with a loud report and blows the cork plug out of the filling hole.

Mk IA1: This grenade consists of an iron body and simulated fuze, all cast in one piece to resemble a Fragmentation Grenade Mk IIA1. The simulated fuze has a removable safety pin and ring. There is a hole in the bottom of the grenade body. There is no charge in either the grenade or the fuze. It is painted black, with a white band at the top.

RIFLE GRENADES

Section I — INTRODUCTION

General

Resembling rockets in their shape because of the tube and stabilizing fin on their after end, rifle grenades are designed for about the same tactical purposes as are hand grenades. Rifle grenades have much greater range, however, and, because of their being launched at greater initial velocities, the forces of set-back and creep are employed in the design of their fuzes.

Launchers

The launcher, on which the grenade is placed for firing, is an extension to the barrel of the rifle or carbine. A special device, integral with the launcher, attaches it securely to the muzzle of the weapon. U.S. launchers are all of the spigot type; that is, the stabilizer assembly of the grenade fits over the launcher.

Classification of launchers

M1—U.S. rifles, caliber .30 M1903, M1903A, and M1903A3.
M2—U.S. rifle, caliber .30 M1917.
M7—U.S. rifle, caliber .30, M1.
M1A3.

The Launcher M7 is secured to the Rifle M1 by a latch which clamps behind the bayonet lug. A valve screw, issued with the launcher, is substituted for the gas-cylinder lock screw. A stud on the launcher protrudes into the valve screw when the launcher is attached, opening the valve and providing for enough gas release to avoid damage to recoiling parts. The valve remains open as long as the launcher is attached to the rifle. The launcher has six gradations for different ranges. The range of the grenade is dependent upon the position of the stabilizer assembly on the launcher. A grenade-retainer spring, slightly larger in diameter than the launcher, holds the grenade at the position on the launcher for the selected range.

The Launcher M8 is similar to the Launcher M7, except that it is secured to the carbine by a simple clamp and wing nut.

If necessity demands, ball cartridges may be fired, even though the launcher is attached, assuming, of course, that no grenade is on the launcher.

Rifle grenade cartridges

Rifle caliber .30 M3: This cartridge is used in U.S. rifle M1, M1903, M1903A1, M1903A3, and M1917. It is loaded in the standard caliber .30 case. The load consists of five grains of black powder and approximately 49 grains of a progressive-burning smokeless powder; the exact amount is adjusted to give the Anti-Tank Rifle Grenade M9A1 a velocity of 165 feet per second at five feet.

Carbine caliber .30 M6: This cartridge is used in the U.S. carbine M1, M1A1, and M1A3. It is loaded in the standard carbine cartridge case with approximately 21 grains of special powder adjusted to give the Anti-Tank Grenade M9A1 a velocity of 145 feet per second at 5 feet.

Auxiliary Grenade Cartridge M7: This cartridge, designed to give additional range when used in firing grenades from rifles and carbines, is a caliber .45 case drawn piece loaded with 20 grains of powder and sealed with a paper wad. It is placed in the end of a launcher, a rim on

the base of the case holding the cartridge in place. It functions only in combination with the standard Grenade Cartridge M3 or M6 and fits the Launchers M1, M2, M7, and M8. When using this cartridge, the rifle or carbine will not be fired from the shoulder.

Part 4 — Chapter 12 — Section 2

RIFLE GRENADES (LISTING)

Anti-Tank M9 and M9A1

Length, inches	11.24
Diameter, inches	2.25
Color	Olive drab
Weight, pounds	1.23
TNT filling, ounces	4

Description: Anti-Tank Grenade M9A1 consists of a body, a stabilizer assembly, and a fin. The body is cylindrical, the two pieces joined in the middle with rounded ends. The stabilizer is a hollow tube which screws into the base of the body and fits over the launcher; it also carries a shroud fin assembly which aids in stabilizing the flight of the grenade. The body is made of cast metal.

The impact fuze, which consists of a striker held away from a detonator by a creep spring and a safety pin, is assembled integrally with the stabilizer assembly. The safety pin projects through the fuze body and clamps around the stabilizer tube. When the pin is withdrawn, a drop of two feet, nose-first, to a hard surface will cause the fuze to function.

This grenade is designed primarily for use against tanks and other armored or resistant targets. It must strike within 20° or normal to be sure to function. However, the velocity of the grenade itself is not a critical factor, as it incorporates the hollow-charge principle. The danger radius to the rear of the explosion is 50 yards.

Operation: The grenade is fired from a rifle by means of a special launcher attachment. A special cartridge is used for propulsion. The grenade must be placed on the launcher before the safety pin is withdrawn. The safety pin is removed before firing. When the grenade is fired, set-back holds the striker away from the detonator. On impact, the striker overcomes the creep spring and hits the detonator.

Remarks: The M9 is an earlier model. It has the same tail assembly, but the head is acorn-shaped and is equipped with a point detonating fuze. It is slightly less sensitive than the M9A1. The safety pin of the M9 is located in the base of the grenade body instead of in the stabilizer tube. Its pull ring is secured to the body with adhesive tape.

Fragmentation M17

Length, inches	9.775
Diameter, inches	2.25
Color	Olive drab
Weight, pounds	1.47
Filling, E.C. powder, ounce	0.77

Description: This grenade consists of a fragmentation-type body similar to the Hand Grenade Mk IIA1 assembled to a fuze and stabilizer assembly similar to that for the anti-tank and practice rifle grenades. The stabilizer and fuze assembly threads into the grenade body.

The fuze is a simple impact type. The striker is held away from the detonator by a safety pin and a creep spring. The safety pin projects through the fuze body and clamps around the stabilizer tube. When the pin is withdrawn, a drop of two feet, nose-first, to a hard surface will cause the fuze to explode the grenade. Detonation will not occur upon impact with water, mud, or soft sand. This grenade is designed primarily for use against personnel.

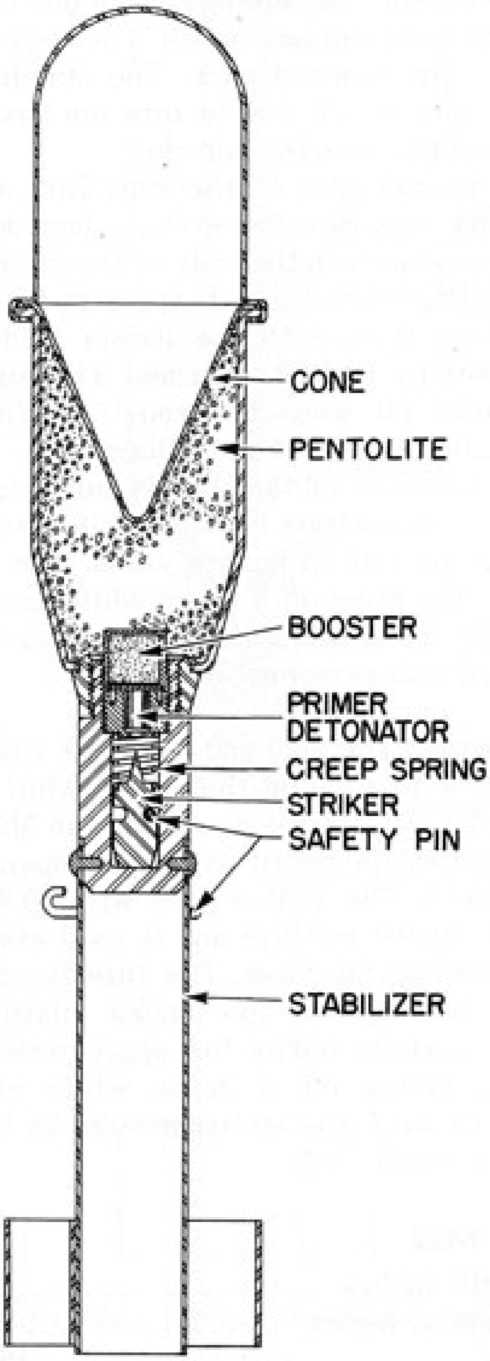


Figure 230. Anti-Tank Rifle Grenade M9A1

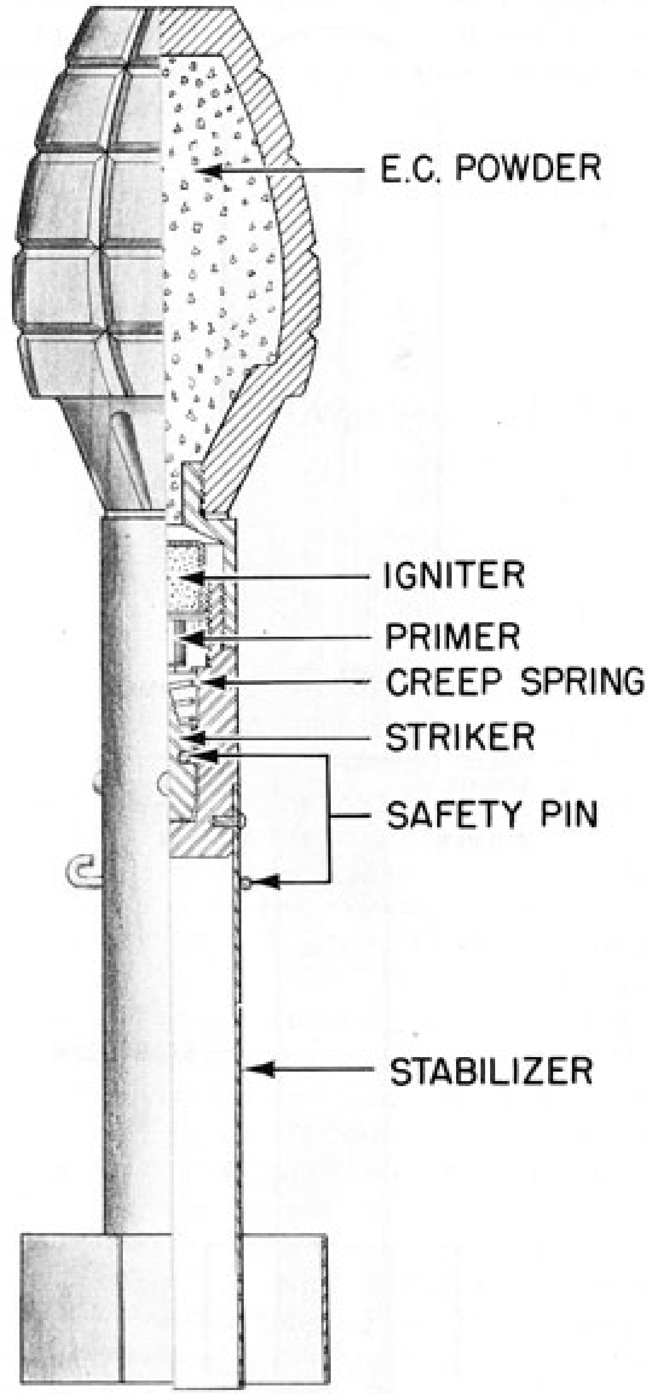


Figure 231. Fragmentation Rifle Grenade M17

Operation: The grenade must be placed on the launcher before the safety pin is withdrawn. The safety pin is removed before firing. When the grenade is fired, set-back holds the striker away from the detonator. On impact, the striker overcomes the creep spring and hits the detonator.

Remarks: The Fragmentation Grenade M17 is no longer in production; however, large quantities were issued.

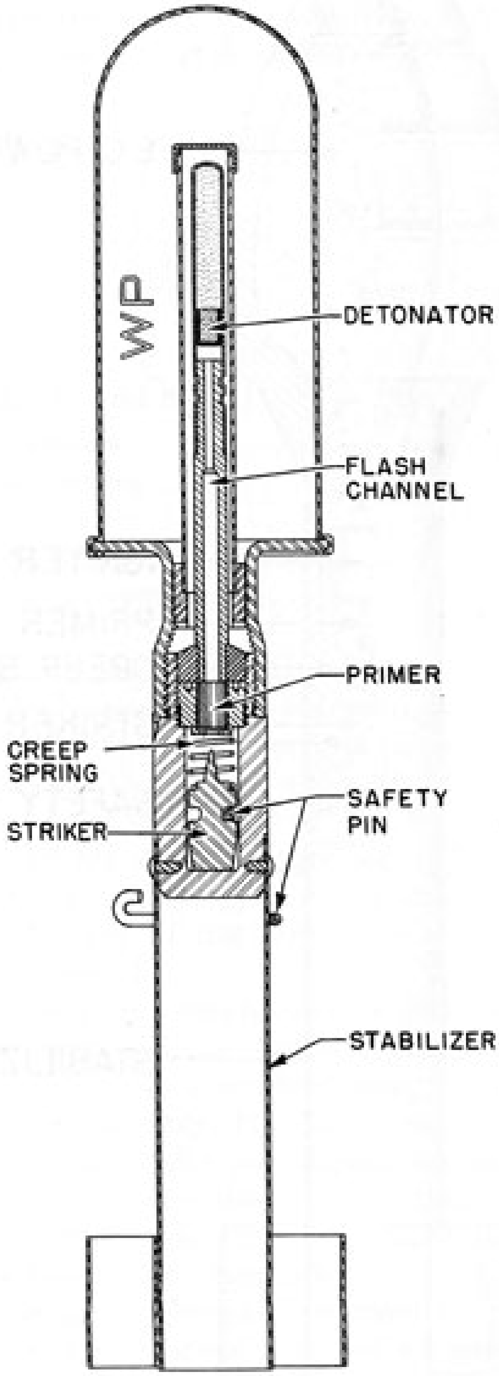


Figure 232. Smoke Rifle Grenade M19A1

Smoke M19, M19A1, M20, and T6E1

Length, inches 11.31
Diameter, inches 2
Color .... Blue grey
Weight, pounds 1.57
Filling.................. White phosphorus

Description: In outward appearance, this grenade is similar to the Anti-Tank Grenade M9A1, except that the body is in one piece and does not have the joining rib. The body is cylindrical, with rounded ends. The stabilizer is a hollow tube which screws into the base of the body and fits over the launcher.

The impact fuze of the Anti-Tank Grenade M9A1 has been modified so that a long detonator which extends into the body of the grenade acts as a burster when the fuze operates. The fuze is an impact type, with the striker held off the detonator by a safety pin and a creep spring. The safety pin projects through the fuze body and clamps around the stabilizer tube.

The explosion of the burster tube breaks the grenade and scatters burning white phosphorus over an area of 25 square yards. The burning phosphorus gives off a dense white smoke. The particles are of incendiary nature and make an excellent anti-personnel weapon.

Remarks: The M20 and T6E1 are rifle smoke grenade with a filling that emits white smoke. The T6E1 is ¼ inch longer than the M20. Both are identical in construction and operation to the M19A1. The M20 is filled with 10.8 ounces of H.C. smoke mixture and is used exclusively for screening purposes. The fuze functions on impact and ignites the smoke mixture. The smoke mixture burns for approximately one minute, giving off a dense white non-toxic smoke through the emission holes in the base of the grenade body.

Smoke M22

Length, inches 10.72
Diameter, inches 2
Color .... Blue grey
Filling .... Smoke mixture

Description: This grenade is similar to the Smoke Grenades M20 and T6E1. In outward appearance, it is similar to the Anti-Tank Grenade M9A1, except that it does not have the joining rib. The nose of the body has a small circular opening which is closed with a light metal cover. The stabilizer contains the Fuze M9A1 Type.

The body is filled through the nose. After

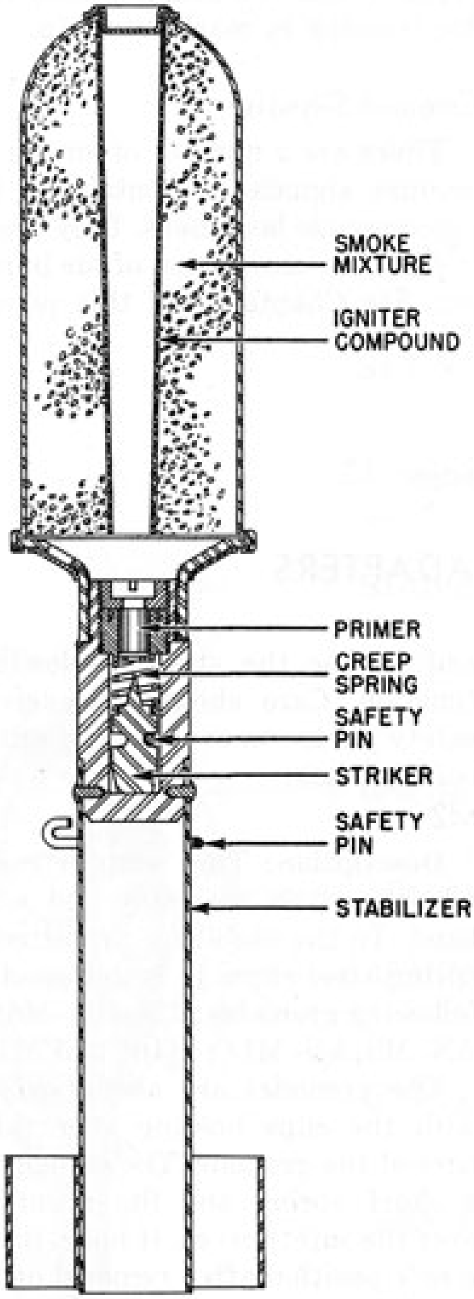


Figure 233. Smoke Rifle Grenade M22

filling, a tool is inserted longitudinally through this nose opening, and the filling is packed against the sides of the body, leaving a central channel. Then this channel is coated with an igniting composition. The smoke-emission holes are through the base shoulder of the grenade body.

Four colors are issued: red, green, violet, and yellow.

The primary use of the grenade is for signaling.

Operation: The igniter ignites the igniting mixture, which initiates the burning of the smoke mixture. Smoke is emitted through the emission holes for one to one and one-half minutes.

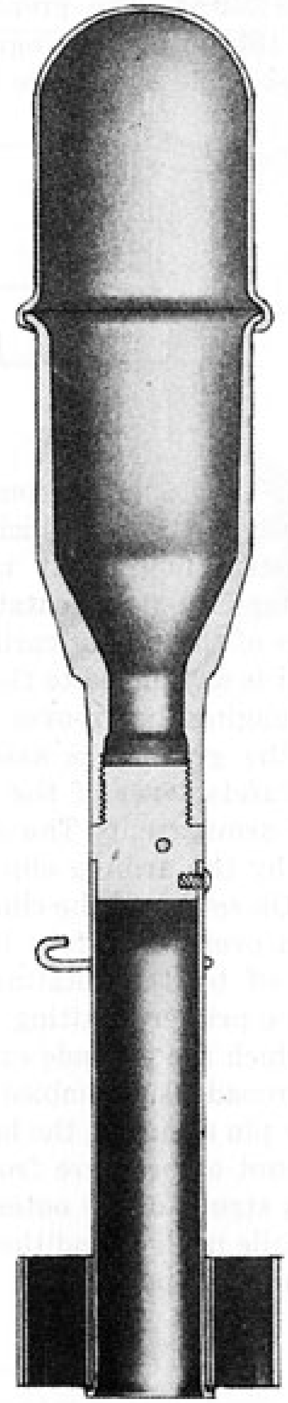


Figure 234. Practice Rifle Grenade M11A3

Practice M11A2 and M11A3

Length, inches	11.18
Diameter, inches	2.25
Color	Black

Description: This grenade simulates the Anti-Tank Grenade M9A1. The grenade is so constructed that the fin and the ogive assemblies, which are most liable to damage in use, may be replaced and the grenade used repeatedly. It is for training in marksmanship.

Ground Signals

There are a number of smoke and flare pyrotechnic signals in containers launched from rifle-grenade launchers. They are used in signaling and for simulation of air bursts of artillery, etc. See Chapter 9 of this pamphlet.

Part 4—Chapter 13

PROJECTION ADAPTERS

M1A1

Description: This adapter consists of a stabilizer and fin assembly to which are attached three spring-steel fingers. It is designed to project the standard fragmentation hand grenade by means of the rifle or carbine. The Hand Grenade Mk II is assembled to the adapter with the fingers engaging the grooves in the grenade body. When the grenade is assembled to the adapter, the safety lever of the grenade is inserted in the arming clip. The safety lever is held in place by the arming clip until the grenade is fired. On set-back, the clip lags and so is removed from over the safety lever, which is then thrown off by the rotating striker. The striker hits the primer, igniting the 4.5-second delay, after which the grenade explodes.

When the grenade is assembled to the adapter and the safety pin removed, the lever bends outward, on account of pressure from the striker. If the lever is struck on its outer surface, near the striker, while in this condition, it is possible that the lever may spring loose from the fuze and release the striker, allowing the fuze to function. Care should be exercised, once the safety pin is removed, to prevent the lever from being struck.

M2

Description: This adapter consists of a stabilizer and fin assembly and a metal set-back band. To the stabilizer are attached four short spring-steel clips. It is designed to project the following grenades: CN–DM–M6; CN–M7; H.C., AN–M8; AN–M14; M16; and M18.

The grenades are assembled to the adapter with the clips holding over the ridge at the base of the grenade. The set-back band contains a short spring and fits around the grenade, over the safety lever. It holds the safety lever in a safe position after removal of the fuze safety pin. When the grenade is fired, set-back causes the band to slide off the safety lever toward the base of the grenade. This permits the safety lever to spring outward and the striker to ignite the fuze. The fuze ignites the grenade in approximately one to one and a half seconds.

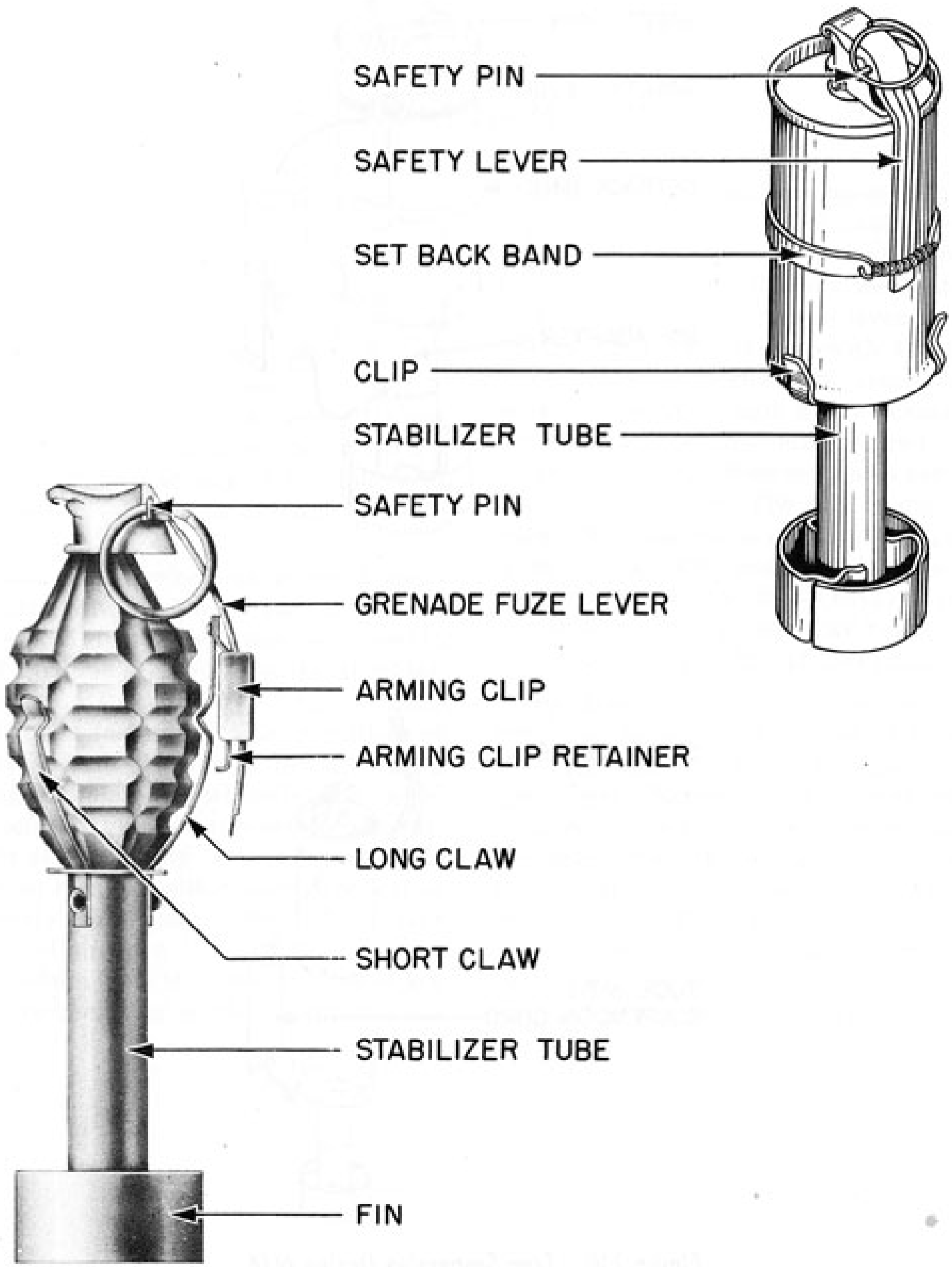


Figure 235. Projection Adapters M1A1 (left) and M2 (right)

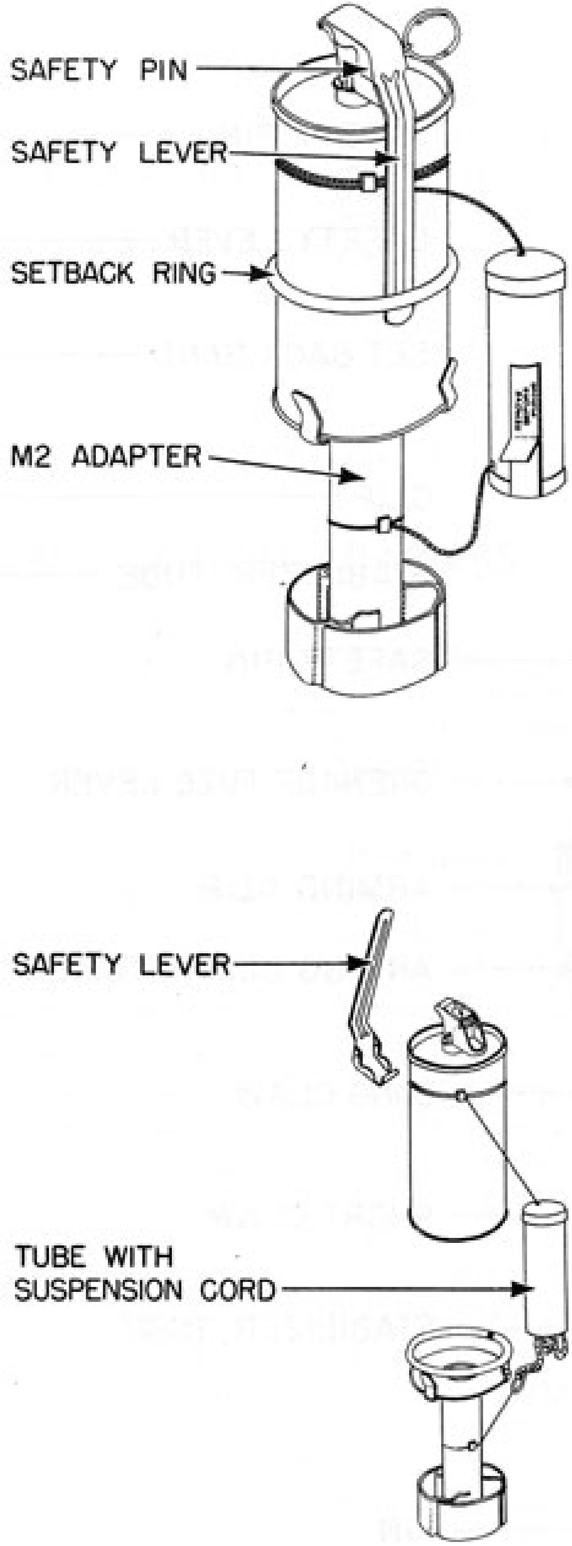


Figure 236. Tree Suspension Device M18 Assembled (above) and Fired (below)

TREE SUSPENSION DEVICE

M18

General: The Tree Suspension Device M18 for smoke grenades is designed to provide a quick and simplified means for suspending standard burning-type smoke hand grenades from trees and foliage to permit emission of smoke above forests and foliage, where it is more readily visible to air observers. It must be used with the Chemical Grenade Projection Adapter M2 assembled to any of the following hand grenades: AN–M8, M16, or M18.

Description: The device has a small cardboard tube into which is loosely packed about a ten-foot length of heavy rayon line. Attached to each end of this line are two light metal cables, one for fastening to the body of the grenade and the other for fastening to the stabilizer of the Adapter M2. It also has a heavier metal set-back ring to replace the set-back band issued with the chemical grenade projection adapter. This heavier set-back ring retains the grenade safety lever in a safe position after removal of the fuze safety pin, releases the safety lever by set-back action upon being fired, and separates the grenade from the adapter by set-back action against the clips of the adapter, upon being fired.

Assembly: The device is assembled for use by slipping the double loop of cable over the grenade body under the safety lever. The set-back ring is slipped over the bottom of the grenade so that it holds the safety lever in place, and the set-back band issued with the grenade is discarded. The grenade is assembled to the adapter, and the single loop of cable is slipped over the adapter fins and secured to the stabilizer tube. The adhesive tape is removed from the cardboard tube. The rifle or carbine is prepared for firing in the usual manner, using positions 3 or 4, at an angle of elevation of 50° or 70° and, normally with the butt of the gun supported by soft earth or other resilient material to avoid the possibility of cracking the stock.

Operation: Upon firing, the entire assembly is projected forward, and the set-back ring strikes the clips sharply, separating the grenade from the adapter. Because of the construction of the adapter, it tends to slow down as soon as it is separated from the grenade. In so doing, pulls the rayon line from the cardboard tube. The grenade then flies through the air, with the adapter trailing at the end of the cord. Upon reaching a tree, the cord and adapter become entangled on branches or foliage, suspending the smoking grenade.

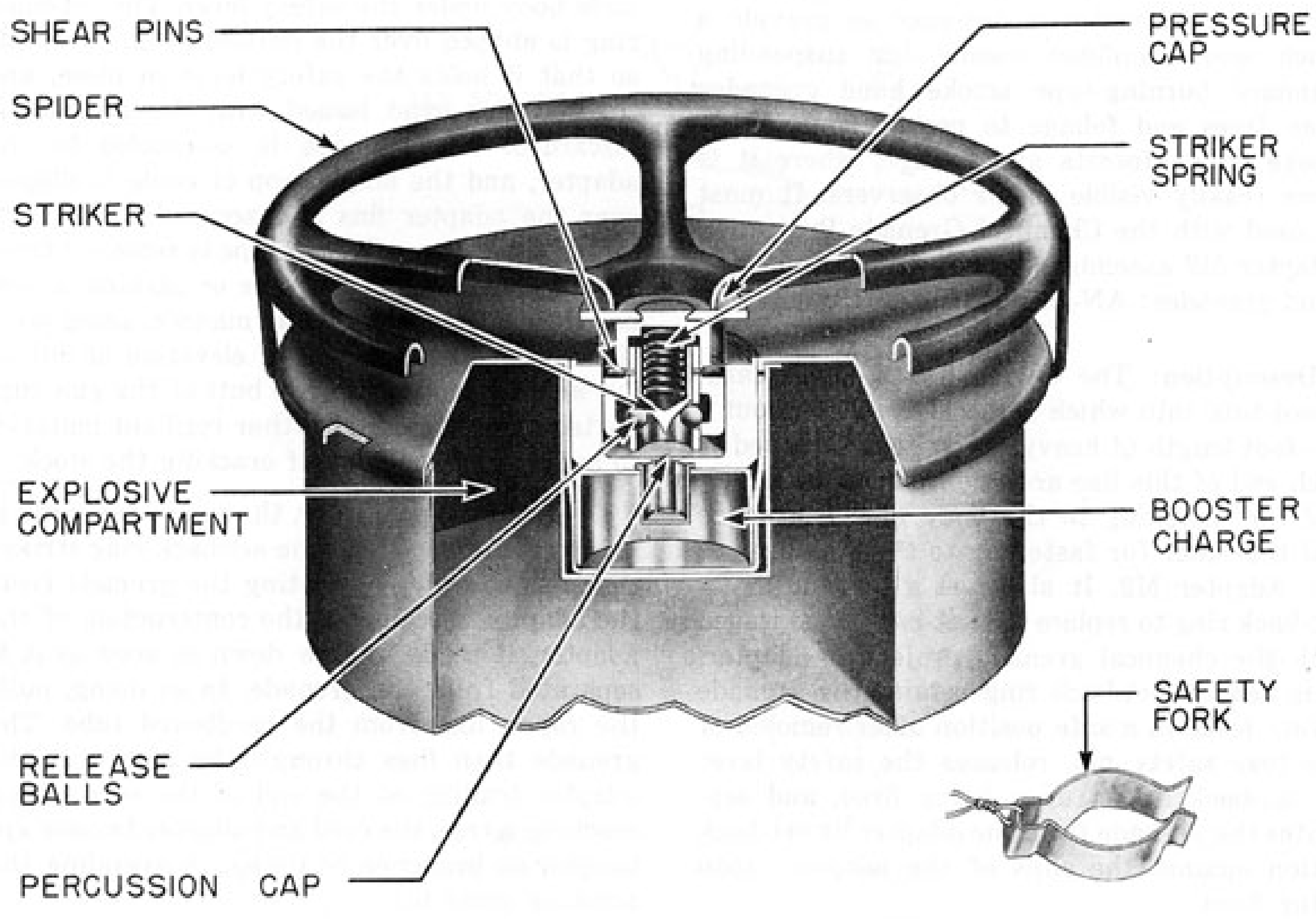


Figure 237. Anti–Tank Mine M1A1

LAND MINES AND FIRING DEVICES

Chapter 15 — LAND MINES

Section 1 — INTRODUCTION

Mine types

There are two common types of land mines: anti-tank and anti-personnel. Anti-tank mines, designed to immobilize track or wheeled vehicles, vary in the amount of explosive they contain, the normal charge being 6 to 12 pounds. They are used in mine fields or road blocks. Anti-personnel mines are used primarily to produce casualties to personnel, and, secondarily, to give local security and warning. The explosive charge varies from ¼ to 4 pounds. Other, less common, mines are classified in the general categories of improvised, dummy, and practice.

Firing devices

Firing devices are classified in accordance with the method of their initiation; that is, pressure, pull, tension-release, or pressure-release. The initiating action causes the device to function by chemical reaction, friction, percussion, or the closing of an electrical circuit.

Anti-tank mines generally have a main fuze which is employed as the primary initiating device; however, some anti-tank mines have supplementary activator wells on the side and bottom for booby trapping.

Marking

Mines can be identified by their color and markings. Land mines are generally painted lusterless olive drab with a yellow base and black markings, while practice mines are painted blue with white markings and dummy mines are black.

Army and Navy types

The Navy does not design land mines, but it has produced three firing devices for use with demolition charges—the Firing Devices Mk 1, Mk 3, and Mk 15. Since these could be adapted for use with mines, they are described in this publication. The Navy also produced the practice firecracker.

Part 5 — Chapter 15 — Section 2

ANTI-TANK MINES

M1A1 (Obsolete)

Diameter, inches	8
Height (with spider), inches	4
Height of body, inches	2.75
Total weight, pounds	10.6
Cast TNT weight, pounds	6
Material	Steel
Fuzing	M1A1, M1A2

Componets: The metallic Anti-Tank Mine M1A1 has three main components: loaded body, fuze, and spider. The spider fits over the fuze to increase the effective size of its head. The steel body is a squat cylindrical container of light steel filled with high explosive. A carrying ring is attached to its side. The flanged rim around the top is notched for attaching the spider. In the center of the top is the cavity for the fuze and booster; the booster fits into the cavity and locks into place. The spider is a ring with two cross members pressed from a single sheet of metal. Hooks on the spider engage the flange on the mine body, and the center hub of the spider rests on the striker head of the fuze. When the mine is packed, the spider is placed over the bottom of the steel body to save space.

Fuze M1A1: This fuze consists of a striker assembly and a body with a primer. The head of the striker assembly protrudes 3/8 inch beyond the body of the fuze. Pressure of 500 pounds directly on the fuze head, or 250 pounds on the edge of the spider, depresses the outer sleeve, cutting the shear pins and aligning the holes in the outer sleeve with the steel balls lodged in the inner sleeve. The steel balls are forced into the holes in the outer sleeve, releasing the striker. The striker, thus freed, driven by the striker spring, sets off the percussion cap, detonator, booster, and main charge, in the order listed. For safety of shipping and handling, a safety fork is fitted over the collar between the striker head and the top of the fuze body.

Fuze M1A2: This fuze is identical in outward appearance to the M1A1. The detonator is more powerful to insure a high-order explosion.

Arming: The safety fork is not removed until after the mine is laid; and, after removal, the fork is left beside the mine, attached to its cord, never between the body and the spider. Before the mine is taken up, the safety fork is replaced.

Color: The bottom and 3/4 inch of the side are painted yellow; the rest of the mine is painted olive drab.

Remarks: The M1, the original model, is no longer being manufactured or issued. The principal difference is that, in the Mine M1, the booster is an integral part of the fuze; in the Mine M1A1 the booster is a separate part and issued assembled in the fuze cup of the mine.

Protective bag covers made of moisture-resistant, mildew-proof fabric are provided with this mine to prevent foreign matter from working between the mine body and the spider. The cover is cylindrical in shape, 8.75 inches in diameter, 9 inches high, and open at one end. The Mine M1A1 is being replaced by the M6.

M4 (Obsolete)

Diameter, inches	8
Height (with spider), inches	4
Total weight, pounds	10.6
Cast TNT weight, pounds	6
Material	Steel

Components: The metallic Anti-Tank Mine M4 is identical to the M1A1 type except for the booster, the fuze, and the activator wells. The M4 has one activator well on the bottom and one on the side. Since the booster, after loading, becomes an integral part of the mine, and since the M1A1 and M4 boosters and fuzes are not interchangeable, it is especially important that the Mines M1A1 and M4 and their respective fuzes be kept separate. However, the two mines are assembled, armed, and employed in the same manner. The advantage of the Mine M4 is that the internal construction of the M4 fuze makes it safe to re-use, because it is not made more sensitive by repeated light blows.

Fuze: The fuze for the Mine M4 functions on the "cricket" or "oilcan" principle. This means that the firing-pin spring is a convex metal diaphragm which snaps down under pressure to detonate the fuze. The fuze for the Mine M1A1 uses a cocked firing pin spring and shear pins. In appearance, the only difference is that the primer and the detonator of the M4 fuze are contained within the fuze body instead of protruding from the bottom as in the M1A1, and the bottom edge is sharp rather than beveled.

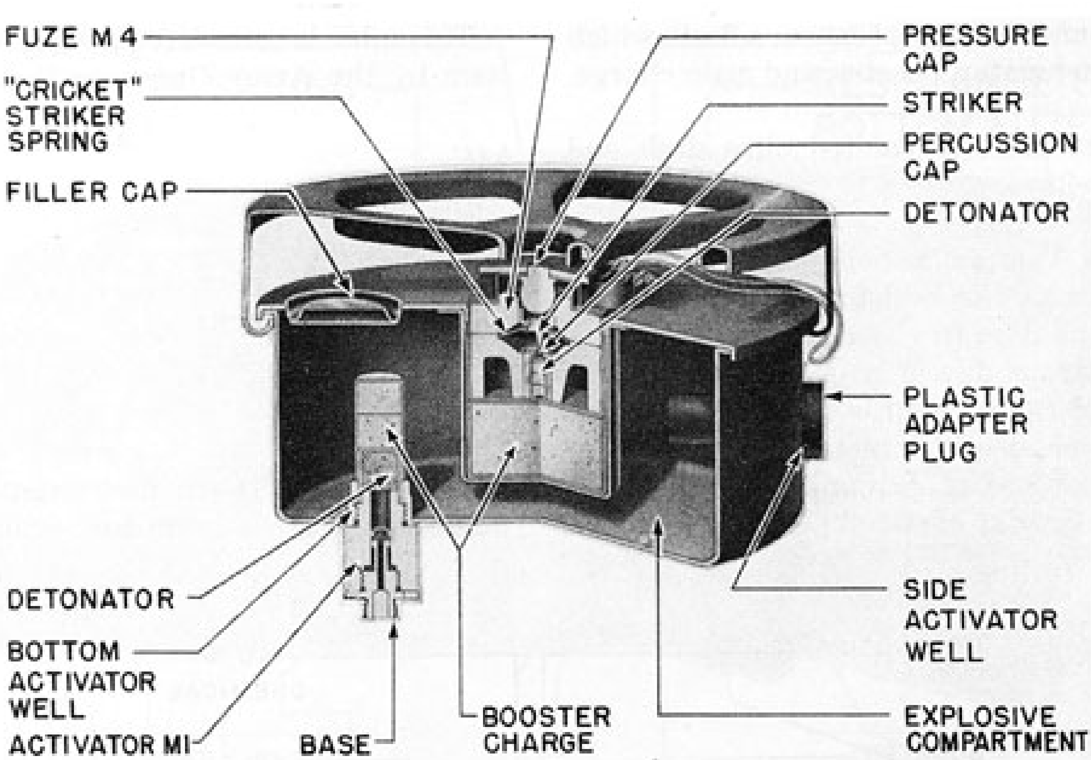


Figure 238. Anti-Tank Mine M4

Booster: The M4 booster is identical with M1A1 booster, except that it has a flat top with a crossed scar to insure rupture of the booster shell by the detonator, while the M1A1 booster has a cavity in the top to receive the protruding primer and detonator of the M1A1 fuze.

Arming: The safety fork is removed from the fuze by pressure of the thumbs on the prongs.

Color: The bottom and ¾ inch on the side are painted yellow; the rest of the mine is painted olive drab.

Remarks: The Mine M4 is being replaced by the M6.

The M4 also has a protective cover bag.

M5

Diameter, inches	10
Height, inches	5.5
Total weight, pounds	14.5
Weight of filler, pounds	5.6
Type of filler	TNT or Tetrytol
Material	Pottery and impregnated felt

Components: The cylindrical mine body consists of a ceramic bowl containing the high explosive, with a ceramic plate which acts as the spider. These components are separated by a cushion of rubber or similar material and enclosed in asphalt-impregnated felt and tarred paper. There is a threaded opening in the top of the mine for assembly of the fuze and a bakelite plug in the bottom, which may be removed for the attachment of an anti-removal device.

Fuze: The Chemical Fuze M5 consists of a cylindrical body attached to a threaded plug. Instead of a metal safety pin, a bakelite cap is screwed on the base of the fuze body. In addition to this cap, there is a safety ring around the fuze body against the flange of the plug, which prevents the fuze from being screwed into the functioning position in the mine. When the mine is armed, a pressure of 275 to 425 pounds pushes down the upper portion of the mine, overcoming the resistance of the synthetic rubber ring. The glass vial is forced down on the striker, bearing on the wooden anvil, and is broken. Mixture of the chemical in the glass vial with the chemical sub-

stance surrounding the vial causes a flash, which sets off the detonator, booster, and main charge.

Color: The mine is painted olive drab and marked in yellow.

Remarks: This is a non-metallic mine in order that it may not be detected by an electromagnetic mine detector.

An anti-lifting device may be attached by removing the rubber plug in the bottom of the mine; however, use of a metal device tends to defeat the purpose of designing the mine and fuze with no metal parts.

This mine is considered a substitute standard item by the Army Ordnance Department.

M6

Diameter, inches	12.5
Height, inches	3.25
Total weight, pounds	20
TNT filler, pounds	12
Material	Steel
Color	Olive drab

Components: The mine consists of a loaded mine body, fuze, and pressure-plate plug. The

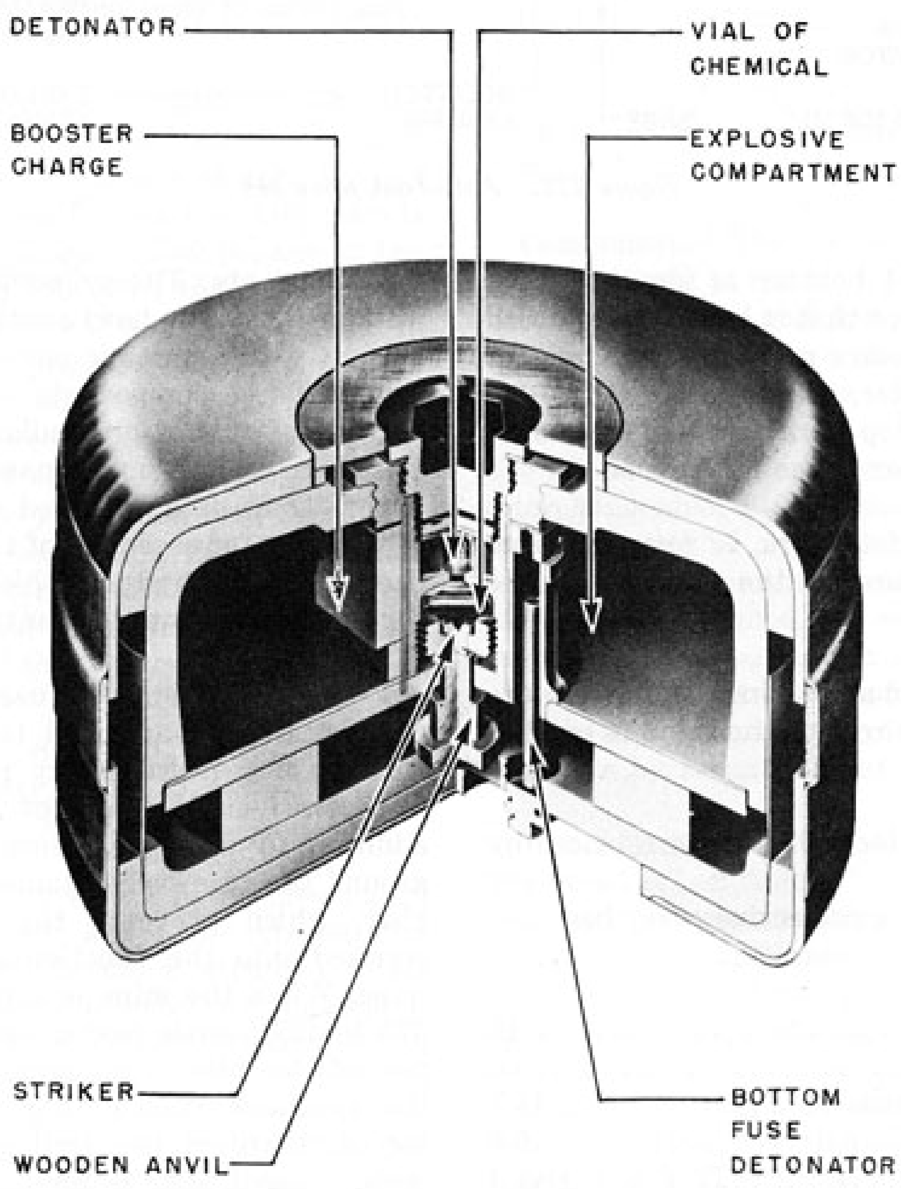


Figure 239. Anti–Tank Mine M5

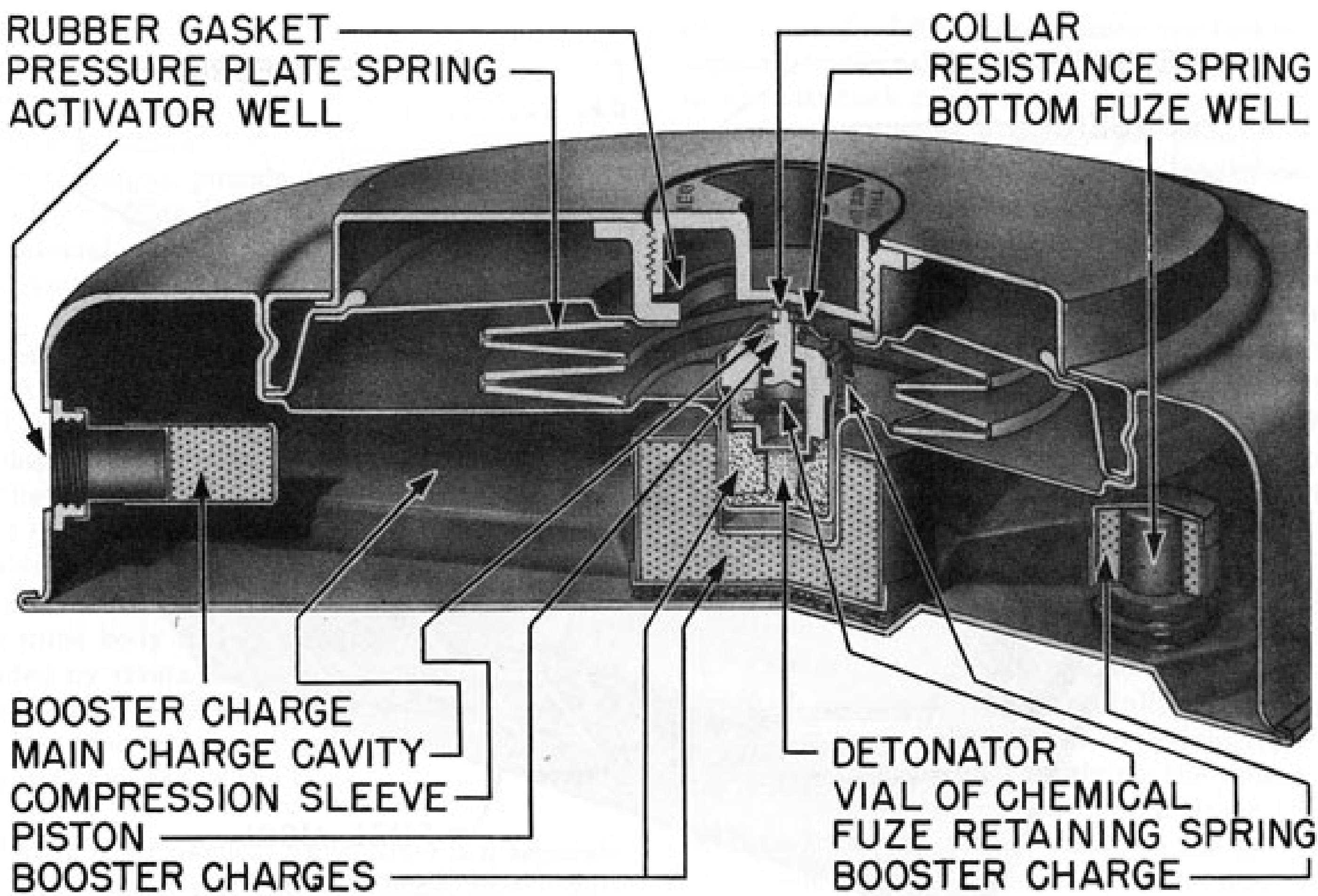


Figure 240. Anti-Tank Mine M6

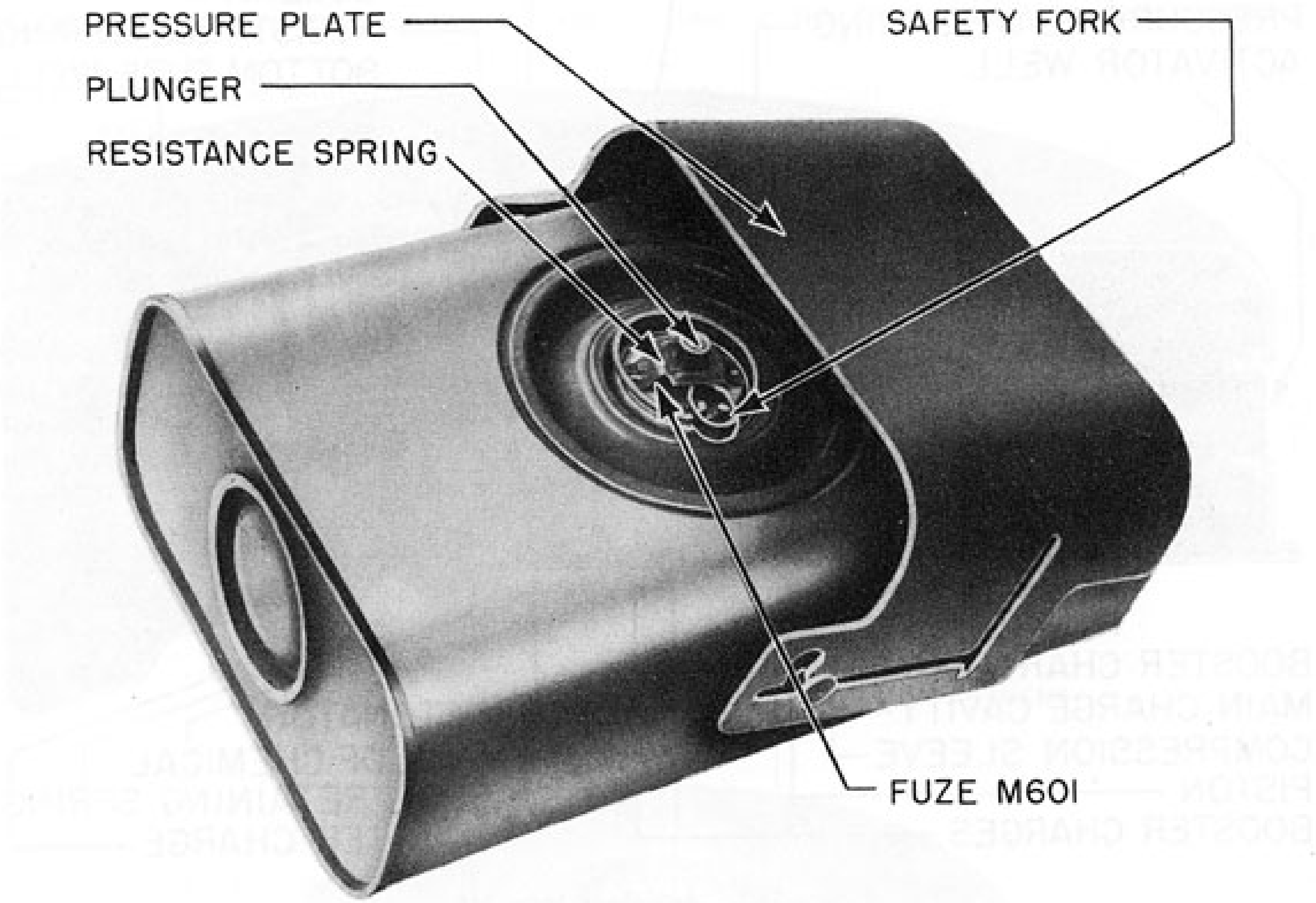
steel body is cylindrical, with a carrying handle attached to the bottom. Assembled to the mine body is a round pressure plate, 7½ inches in diameter, containing the reversible pressure-plate plug which covers the fuze well. The pressure plate is supported internally by circular Belleville springs and sealed against moisture by a rubber diaphragm. In addition to the primary fuze well, supplementary fuze wells are located on the side and on the bottom of the mine for use in anti-lifting or booby-trap purposes.

Fuze: The Chemical Fuze M600 is a separate unit and consists of the fuze body, piston, safety key, compression sleeve, resistance spring, vial of chemical, detonator, and fuze booster charge. The spring is cut away at either side, and the perforations in the sleeve are large so that the fuze itself may be activated by a force of 190 pounds. When the Belleville spring is inserted in a Mine M6, a pressure of 300 to 400 pounds is required to overcome its resistance.

When pressure is applied on the pressure plate, it is transmitted to the piston head. As the resistance of the spring is overcome, the compression sleeve is crushed, and the piston moves down to crush the vial of chemical. The chemical reacts with the surrounding mixture to set off the detonator, fuze booster, booster, and main charge.

Remarks: For booby traps or anti-removal devices, after the main fuze is installed, any standard firing device may be attached to the supplementary fuze wells by using the Activator M1. This activator is a plastic adapter approximately two inches long, which contains a tetryl booster charge.

This fuze must not be used with the Anti-Tank Mine M7.



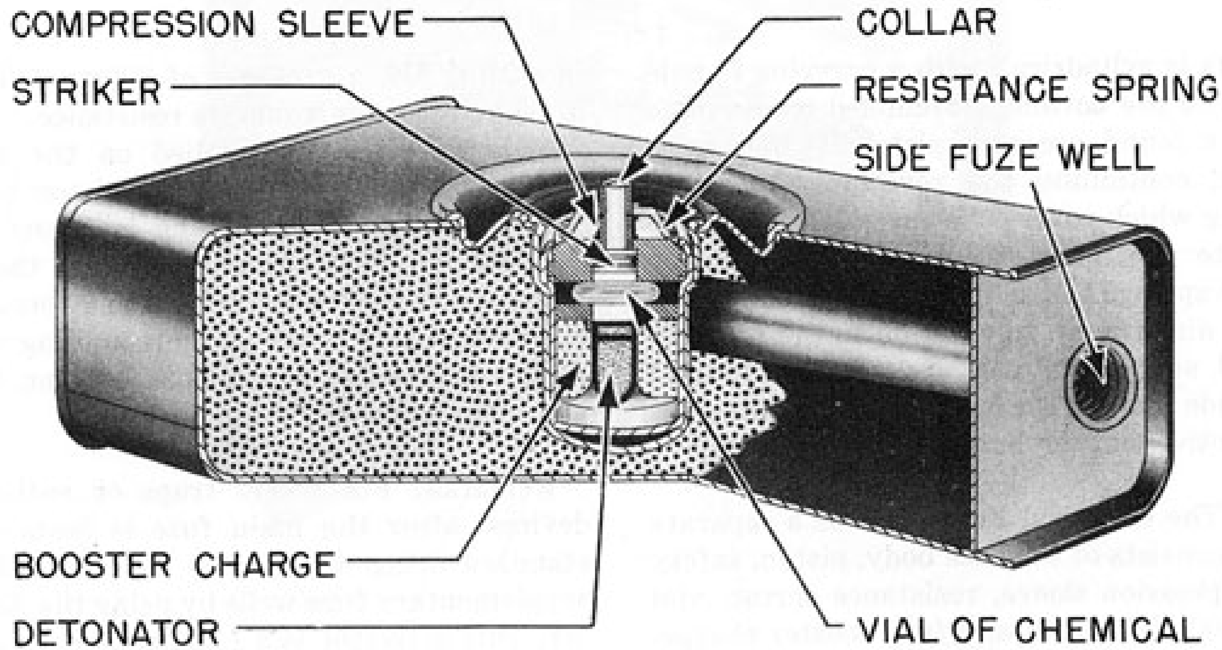


Figure 241. Anti–Tank Mine M7A1

M7A1

Length, inches	7
Width, inches	4.5
Height, inches	2.5
Total weight, pounds	4.5
Tetrytol filler, pounds	3.25
Material	Steel
Color	Olive drab

Components: This mine can be used as either an anti-tank or an anti-personnel mine. The body is a rectangular steel container filled with high explosive. The fuze well is located in the center of the top surface, and at one end is an activator well that will accommodate any standard firing device with a Corps of Engineers' blasting cap. The pressure plate is shaped to the contour of the mine body and is slotted so that it may be guided by rivets in the sides of the mine body, into position over the fuze. A small circular pad on the underside of the pressure plate bears against the head of the fuze.

Fuze: The Chemical Fuze M600 is a separate unit and consists of the fuze body, safety key, piston, compression sleeve, resistance spring, vial of chemical, detonator, and fuze booster charge.

When pressure is applied on the pressure plate, it is transmitted to the piston head. As the resistance of the spring is overcome, the compression sleeve is crushed, and the piston moves down to crush the vial of chemical. The chemical reacts with the surrounding mixture to set off the detonator, fuze booster, and main charge.

Remarks: For a booby trap or anti-personnel mine, any standard firing device may be attached to the side fuze well.

Improvised mines

General: The bangalore torpedo and the 2.36-inch anti-tank rocket can both be used as anti-tank mines, with slight improvisations.

Bangalore torpedo: Special torpedo caps are furnished with each box of ten bangalores, to adapt the bangalore torpedo for use on an anti-tank mine. Pull-firing detonators are furnished separately. To assemble the bangalores for use as an anti-tank mine, insert detonators in two torpedo caps; place a safety pin through the torpedo-cap ears and the detonator loop of each; and snap a torpedo cap onto each end of the torpedo, so that the detonator fits into the cap well. Lay the torpedo on the ground across a wooden block and drive eight-inch spikes on drift pins into the ground as close to the ends as possible. Pass the detonator wire through each detonator loop, and attach the wire to the spike. Make sure there is no tension on the detonator wire. Withdraw the safety pin. The mine is now armed and ready for use.

2.36-inch A/T Rocket: The A/T Rocket M6 may be employed by placing the rocket, nose-up in its container, in a hole about two feet deep, either in a roadbed or horizontally on the side of a cut or bank. It can be set to fire electrically by arranging a circuit containing the rocket, a battery, and an improvised circuit closer. Connections to the rocket are made on the ignition wires: one from the brass ring on the nose, the other from the fins. Ordinary field telephone wire will serve; the battery and connections should be protected from water if necessary.

The container cap is removed and the other end knocked out. The container is thus a guide for the rocket. A hole is punched in the container cap, through which the electric firing-device wires (or trip wire) are run. When connections have been made, the container cap is slid in place over the fins to protect the contacts from fouling. The rocket safety pin is removed; the container tube is slid over the rocket and joined to the cap; and the assembly is placed in the hole. Loose dirt and leaves are then placed over all of the rocket except the nose; the nose is concealed by covering with leaves or light bunches of grass. Care must be taken not to bump the nose, as the rocket is completely armed when the safety pin is removed.

Practice types

General: Practice mines are used in training. These mines can be identified by their blue color and white markings.

M1: The Practice Mine M1 consists of three components: an empty mine body, a spider, and a fuze. The parts are similar in construction to the high-explosive mine, except that the body has five one-inch holes equally spaced around the side. The explosive filling consists of a caliber .32 blank cartridge in the fuze, 100 grains of red phosphorus, and 60 grains of black powder.

M1B1: The Practice Mine M1B1 is made of sheet metal and resembles the service mine, except that the filling hole is in the bottom of the mine body. The body is sand-filled to weight before it is issued for use in practice. Four sections are cut out of the top of the body near the fuze well, to permit the passage of smoke.

T8E1: The Practice Mine T8E1 simulates the standard Mine M6. It uses the Practice Fuze T20, which simulates the M600, but gives a puff of smoke instead of detonating the mine. Four sections cut out of the top of the body near the fuze well permit the passage of smoke.

M10: The Practice Mine M10 simulates the standard Mine M7A1. It is loaded with 3.4 pounds of inert filler, consisting of Santo wax M, 50%, plaster of paris, 12%, and powdered red iron oxide, 38%. It uses the Practice Fuze T20. Four sections cut out of the top of the body permit the passage of smoke.

Part 5 — Chapter 15 — Section 3

ANTI-PERSONNEL MINES

M2, M2A1, M2A2, M2A3, M2A3B1, M2A3B2, M2A4, and M2A4B2

	M2A1
Over-all height, inches	6.5
Case diameter, inches	2.5
Base diameter, inches	5.25
Weight of shell, pounds	3
Weight of explosive, pound	0.4
Material	Steel
Lethal range, feet	60

General: The M2 is a "bounding" anti-personnel mine, usually activated by a combination firing device. The M2 has undergone several structural modifications to make it watertight. The mine consists of an explosive shell contained in an upright thin-walled steel tube which is riveted to the base plate. A cavity in the base plate contains the propelling charge, which consists of 20 grains of black powder in a small bag. The tube containing the shell is sealed at the top by a metal cap. A ¼-inch pipe nipple threaded to the base plate serves as a connection for the firing mechanism. Attached to the pipe nipple is a coupling into which is fitted the primer and igniter assembly. The primer is protected during shipment by a hexagonal cap.

Modifications: The Mine M2 has been modified in that the thin-walled steel tube is silver-soldered to the base (M2A1), or stamped (M2A3), instead of being riveted (M2). The Mine M2A3B1 is a modification in which the tube, base, and nipple are cast in one piece. The mine was approved but not issued, being too heavy. The Mine M2A3B2 is a combination of the M2A3 and the M2A3B1, in that the base is cast but the tube and nipple are stamped to the base. In the M2A4, which has two propellant bags, the tube and nipple are welded to the base, while, in the M2A4B2, the tube and nipple are welded to a base which is cast. The M2A2 was a field modification thought to involve the use of a canvas bag.

Fuzing: These mines are usually fuzed with the Combination Fuze M2 or M2A1 consisting of the combination firing device M1 with an igniter cap attached, or with the combination Fuze M6.

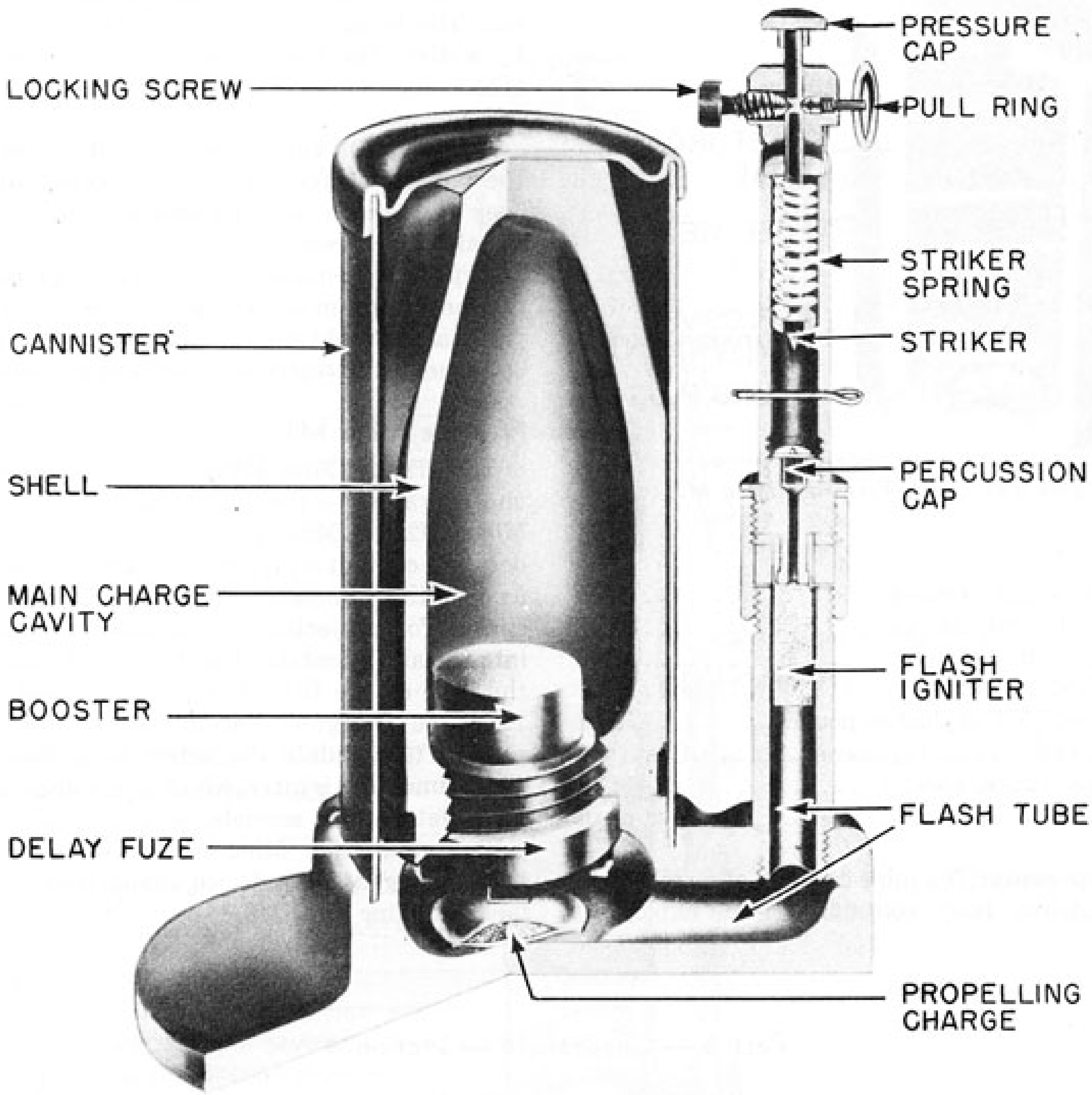


Figure 242. Anti-Personnel Mine M2A1

Operation: The mine is similar to a small mortar. When the fuze is actuated, the primer sets off the igniter. The flash from the igniter sets off the propelling charge in the base plate. The propelling charge projects the shell into the air and at the same time ignites the delay fuse in the base of the shell. When the shell is at a height of approximately six feet above the base plate, the delay fuse fires a tetryl booster, which detonates the main charge. The effective lethal range of the shell is 60 feet.

Color: The mine and firing device are dull olive drab in color except for the base flange, which is yellow.

Remarks: Each mine is packed in a corrugated paper carton with firing device, attached igniter, and four spools of wire. Markings of "Olive Drab" or "Sand Color" on outside of container refer to the color of the wire.

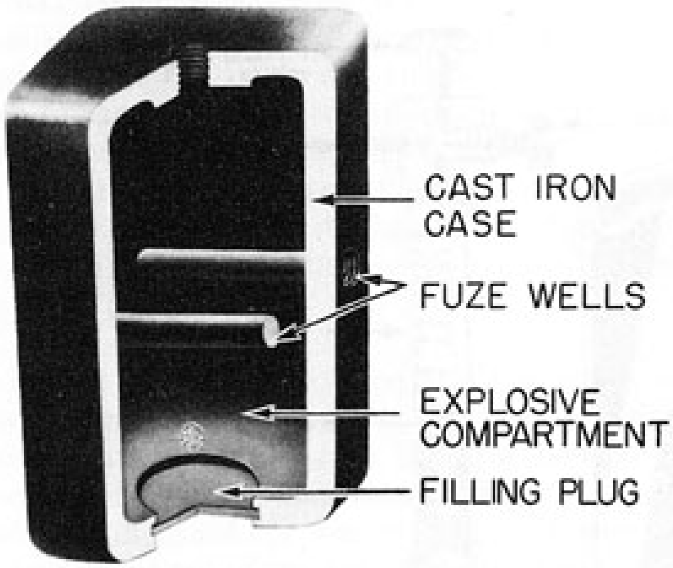


Figure 243. Anti-Personnel Mine M3

M3

Body length, inches	5.4
Body height, inches	3.5
Body width, inches	3.5
Weight, pounds	9.6
Flaked TNT explosive, pound	0.9
Material	Cast iron
Lethal range, feet	30
Color	Olive drab

Components: The mine consists of a rectangular cast-iron body containing high explosive, with fuze wells on two opposite sides and one end. The filling hole on the other end is closed by a disc. The mine is activated by the Fuze M7A1.

Remarks: On the surface, the lethal range of the mine is 30 feet. If the mine is buried only deep enough to be camouflaged, the effective lethal range is reduced to approximately 10 feet.

Exposure to moisture will not affect the operation of the mine; however, it is not waterproof and should not be planted where it will be immersed in water for more than a few days.

Practice Mine M8

The Practice Mine M8 is similar in appearance and operation to the M2A3. Obsolete bodies of Mines M2 and M2A1B1 are utilized. This mine does not contain a propelling charge in the base, as does the standard H.E. mine. The propelling charge for projecting the cardboard projectile into the air is contained in the igniter charge on the base of the fuze. The projectile contains a 12-gauge shotgun charge loaded with black powder to simulate the action of a live mine. The primer and igniter, which has a delay of approximately five seconds, is activated by the M10 Combination Mine Fuze. This fuze is a three-pronged firing device similar to the Combination Mine Fuze M6.

Part 5 — Chapter 15 — Section 4

TRIP FLARES FOR MINE FIELDS

M48 and M49

General: Trip flares are used as a warning device in forward edges of mine fields. They can replace or supplement anti-personnel mines, especially when the field is being hastily prepared. The flares give warning of approaching patrols entering the mine field and illuminate the area so that effective fire can be directed at intruder.

M48: This is a mortar-type parachute flare similar in appearance to the M2 series of anti-personnel mine. The flare, weighing a total of five pounds, has a metal case which is painted olive drab. In operation, the functioning of the igniter sets off the propelling charge, which projects the canister into the air and ignites the delay fuse in its base. When the canister is 300 to 500 feet in the air, the delay fuse sets off the propelling charge in its base, which forces the flare and parachute out of the canister and sets off the ignition charge at the base of the flare.

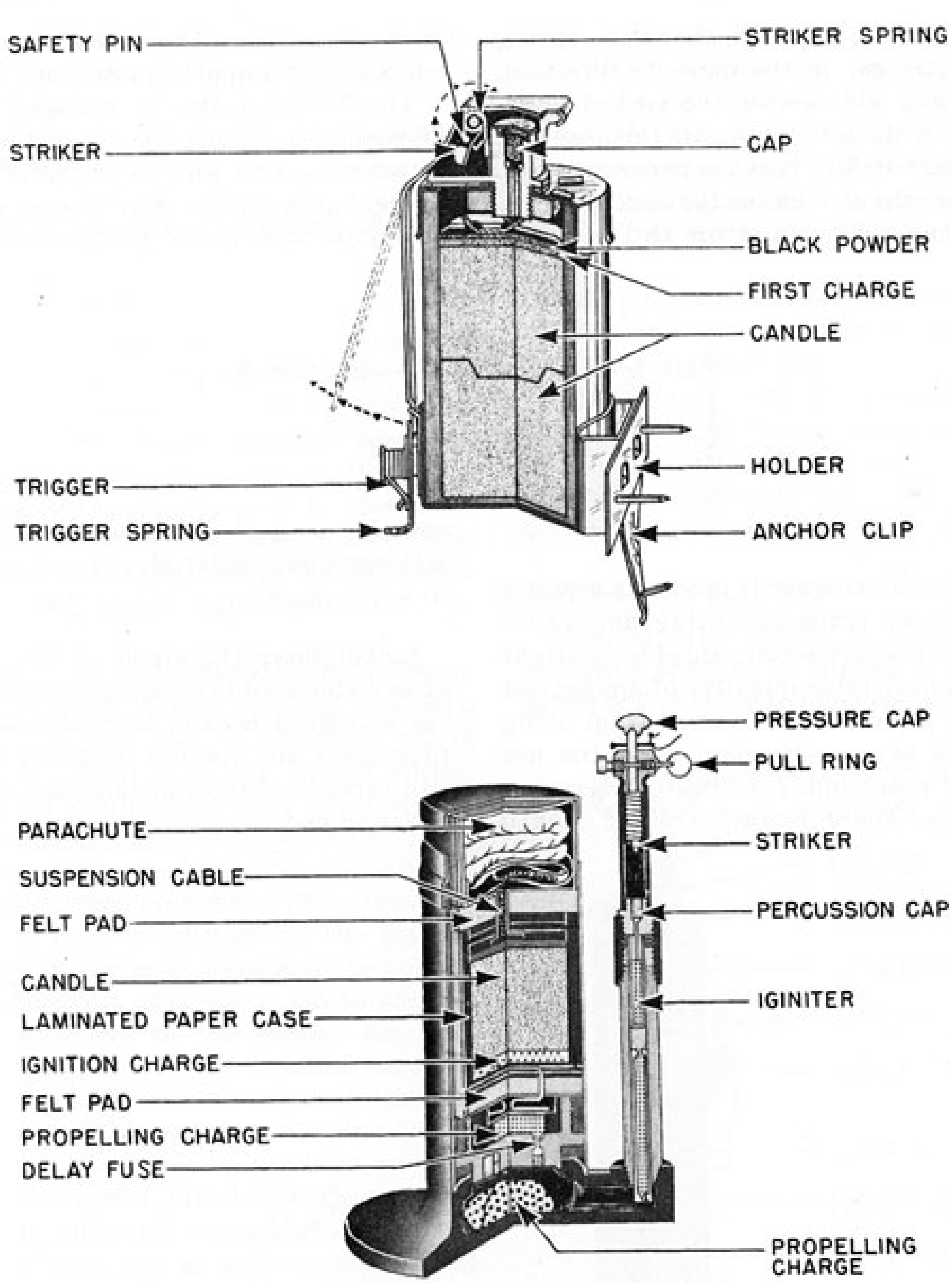


Figure 244. Trip Flares M48 (below) and M49 (above)

The parachute unfolds, and the ignition charge ignites the flare, which burns for 20 seconds. It illuminates effectively a circle of 300 yards radius.

M49: This is a candle flare for use above the ground. The flare, weighing a total of 1.4 pounds, has a laminated paper body with metal fittings which are painted olive drab. Functioning of the flare is similar to that of the Fragmentation Hand Grenade Mk II. The flare is installed with a taut trip wire which holds the trigger in an armed (vertical) position against the pressure of the trigger spring. An additional pull of two to nine pounds on the trip wire pivots the trigger against the pressure of the spring, or release

of the tension in the trip wire allows the spring to pivot the trigger in the opposite direction, either of which will release the cocked lever. The pressure of the striker throws the lever off, and the released striker fires the percussion cap. The flame from the cap ignites the black powder, which blows out the top and ignites the illuminant composition. The flare produces a brilliant white light for approximately one minute.

The M49 can also be installed with a loose trip wire by having the trigger horizontal and attaching a trip wire to the safety pin. A subsequent pull on the wire would withdraw the safety pin and permit the flare to fire.

Part 5 — Chapter 15 — Section 5

FIRECRACKER

Mk 2 Mod 0

General: The firecracker is used as a practice charge for booby traps and firing devices. It produces a loud report accompanied by a bright flash and a considerable quantity of smoke, yet it is designed to reduce the hazard from flying particles such as are attendant upon the use of a standard potassium perchorate firecracker or flash salute. The Firecracker Mk 2 Mod 0 contains no high explosive. It is coated with a waterproofing material, yet it should be stored in a dry place.

Installation: The nipple of the coupling base of any standard firing device is pushed through the wax-filled hole in the hollowed end of the firecracker and rotated clockwise until at least two threads of the coupling base are inside the hollowed end.

FUZES AND FIRING DEVICES

Pull Firing Device M1

General: It is a mechanical device designed for firing charges by a trip wire. A direct pull of three to five pounds applied to the ring actuates the device. A spring-driven firing pin sets off the percussion cap, which, in turn, sets off the non-electric cap crimped to the base. This cap detonates the explosive charge. The new model has two safety pins; the old model did not have the positive safety pin.

Description: The principal parts are the body, release pin, washer, firing pin, and standard nipple base. The split head of the firing pin is forced against pressure of the striker spring through a small opening formed by the shoulders inside the body. The release pin enters into and expands the split head of the firing pin against these shoulders, thus preventing its return. The release pin is held in position by the loading spring. Holes in the main head and the release pin permit insertion of a safety pin to prevent accidental movement of the release pin. The main head or upper body is threaded onto the lower body. A short piece of wire is attached at the side to be used in anchoring the device.

The new model differs in that the positive safety pin was added just below the striker; water-proofing material was added around the nipple of the base; and an anchor cord is used in place of the wire. The head of the body differs slightly in construction, and the joint is soldered to prevent disassembly.

Operation: When the device is set with the blasting cap crimped to the base and inserted in an explosive charge, the top safety pin is removed. After checking the device, the positive safety pin in the lower part of the body is pulled free (new model), and the device is in an armed condition. A pull of three to five pounds on the release pin is sufficient to overcome the resistance of the loading spring and cause the tapered end of the release pin to be withdrawn from within the split head of the firing pin. The split head, no longer being forced against the internal shoulders of the body, slips through under the influence of the striker spring, which drives the striker down on the percussion cap.

Pull Friction Fuze M2

General: This device is designed for firing explosive charges by means of a trip wire. A direct pull of three to nine pounds will actuate it.

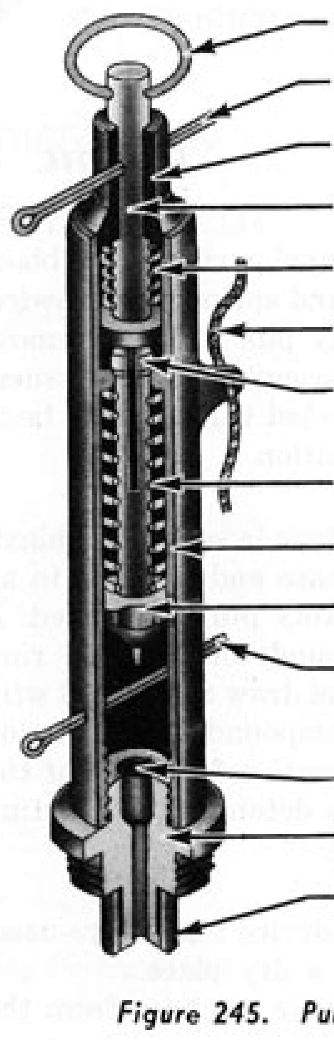


Figure 245. Pull Firing Device M1

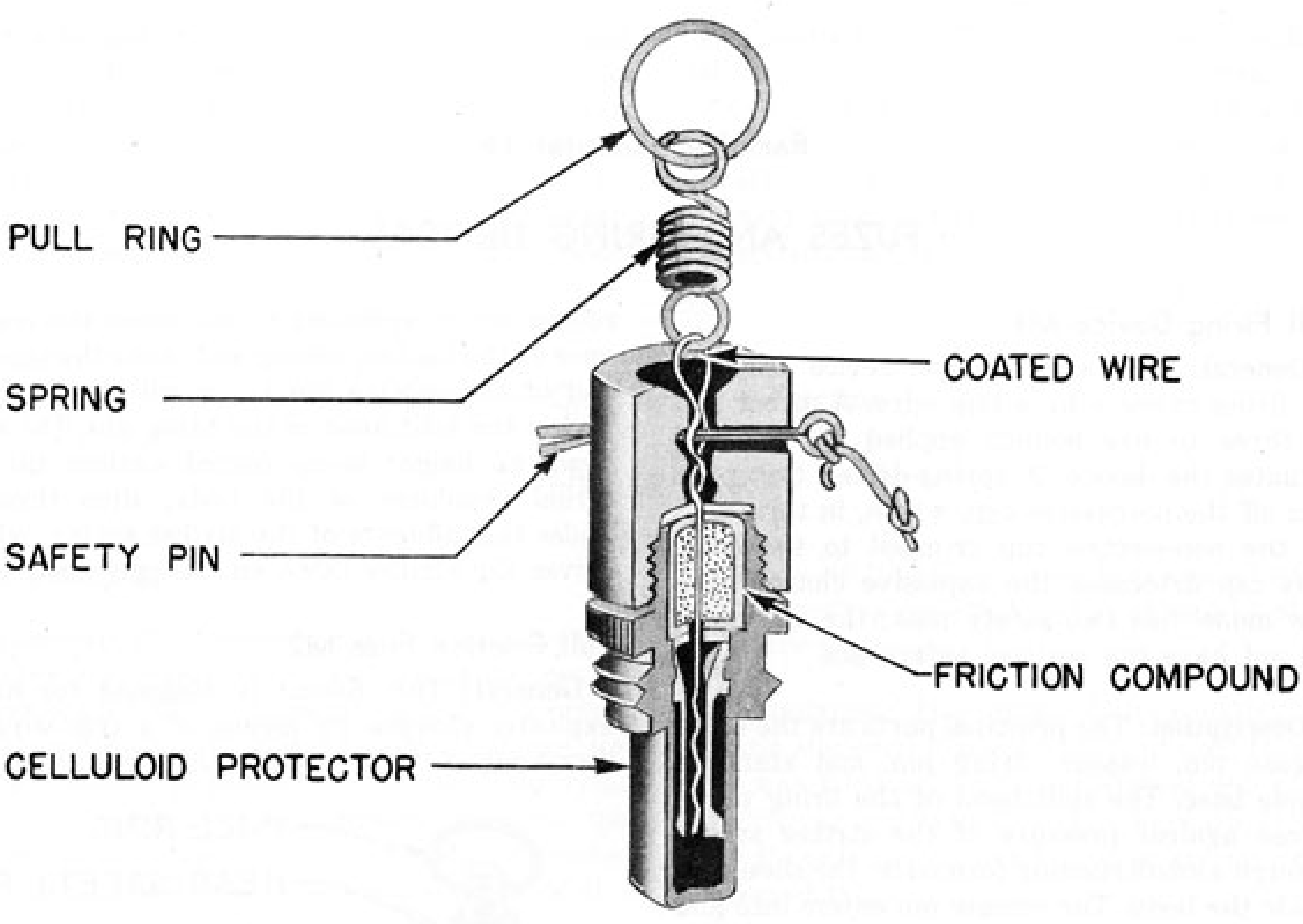


Figure 246. Pull Friction Fuze M2

Description: The principal parts are the black bakelite body, pull ring and spring, coated wire, friction compound, safety pin, and non-removable base. The fuze is assembled when issued, with the safety pin inserted through the body to prevent premature ignition.

Operation: When the fuze is set with a blasting cap crimped to the base and inserted in an explosive charge, the safety pin is removed. A pull of three to nine pounds on the pull ring will stretch the spring and draw the coated wire through the friction compound. The friction compound ignites and shoots a flame out of the open end of the base, to detonate the blasting cap and the main charge.

Remarks: An unfired device may be re-used, provided it has been in a dry place.

Do not attempt to remove the base from the fuze body.

Pressure Firing Device M1A1

General: This is a mechanical device designed to fire explosive charges by means of pressure. A pressure of 20 pounds or more applied to the trigger pin will actuate the device. Various extensions, for attachment to the pressure head, are issued with the device, in order that it may be adapted to varying circumstances.

Description: Principal parts are the body, trigger pin and pressure head, striker spindle, standard nipple base, safety clip, and safety pin. The projection of the trigger pin which extends down into the body has two holes of varying diameter with an inter-connecting slot. The hole toward the bottom of the trigger pin is the smaller. The striker spindle has a circumferential groove around the part that extends through the trigger pin. When the device is set, the trigger pin is held up either by a clip or just by its spring, and the grooved part

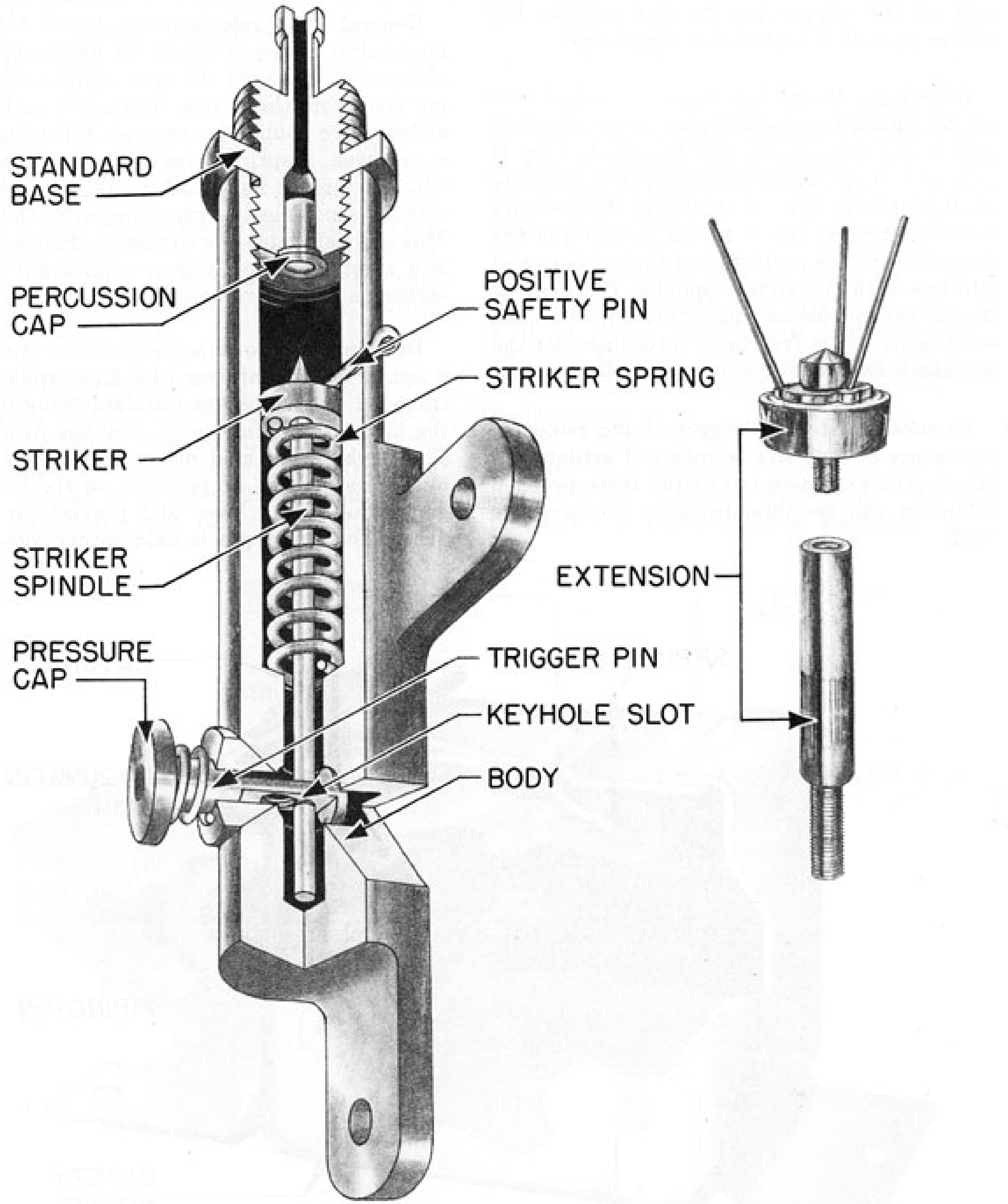


Figure 247. Pressure Firing Device M1A1

of the striker spindle is engaged in the smaller hole on the trigger pin. In this position the striker spindle is locked and cannot fire.

Operation: When the device is armed, the striker spindle is engaged in the lower (smaller) hole in the trigger pin, and the pin in turn is held up by the trigger-pin spring. If a pressure of 20 pounds or more is applied to the pressure head, the trigger pin is forced inward and the larger hole in the projection of the pin is moved into line with the striker spindle. The head of the striker spindle can pass through this hole, and the striker is free to be forced against the percussion cap by the compressed striker spring.

Remarks: With the trigger spring removed, a pressure of only five pounds will actuate the device. The extension rod or the three-pronged extension can be threaded into the pressure head.

Release Firing Device M1 (Obsolete)

General: The release-firing device M1 is a mechanical device designed for firing explosive charges by means of the removal of a restraining load from the device. A restraining load of at least two pounds is required. When the load is removed, a spring lever strikes a firing pin, which detonates a percussion cap. This, in turn, sets off a non-electric cap crimped to the base. This cap detonates the explosive charge. There is a safety pin, and a lever interceptor which serves as a positive safety pin.

Description: The principal parts are the body, a square metal container with a protruding nub threaded to receive the standard firing nipple; the latch; the spring lever; and the firing pin. The latch, when held down against the body by the safety pin or pressure on the box, engages the spring lever and prevents it from firing. The firing pin is held rather loosely in

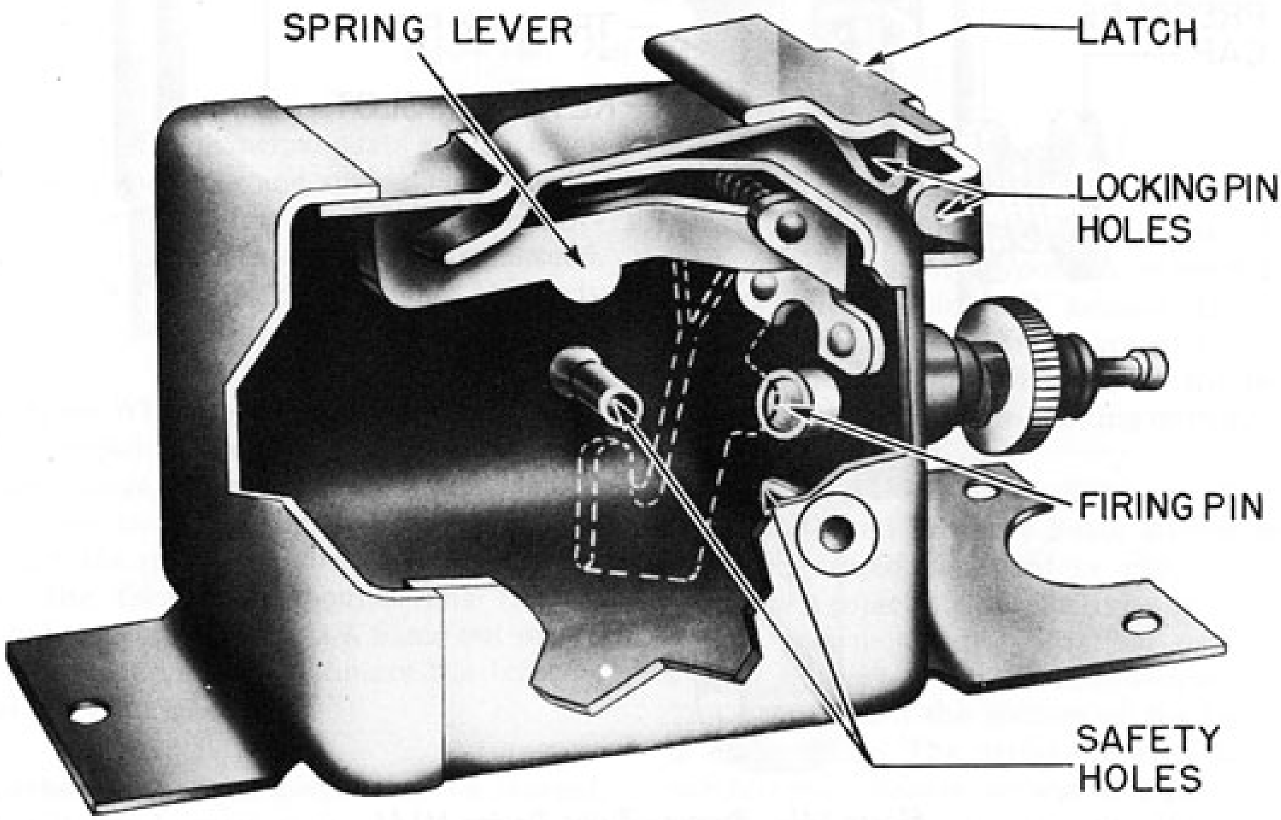


Figure 248. Release Firing Device M1

place, having leeway for slight horizontal motion. When the nipple is threaded on, it forces the firing pin back as far as it can go, the firing pin point resting squarely against the surface of the percussion cap.

Operation: When the device is set with a weight on top and both safety pins removed, it is in an armed condition. If the restraining weight is removed, the latch releases the spring lever. The spring lever will then snap down against the firing pin and drive it into the percussion cap in the standard nipple base, setting off the charge.

Release Firing Device M5

General: The Release Firing Device M5 is a mechanical device designed for firing charges by the removal of a restraining load from the device. A load of at least five pounds is required. When the load is removed, a spring-loaded striker swings over to detonate the percussion cap.

Description: The parts are a rectangular metal body and release plate, a striker and spring, a safety pin, and a standard nipple base. The release plate, when held down by the safety pin or by a weight, prevents the striker from swinging over to detonate the percussion cap.

Operation: When the device is set with a weight on top and the safety pin removed, it is in an armed condition. If the restraining weight is removed, the release plate is forced up by the striker as it swings over to detonate the percussion cap.

Remarks: Because of difficulty in handling, the M5 is considered a temporarily standard item which will ultimately be replaced.

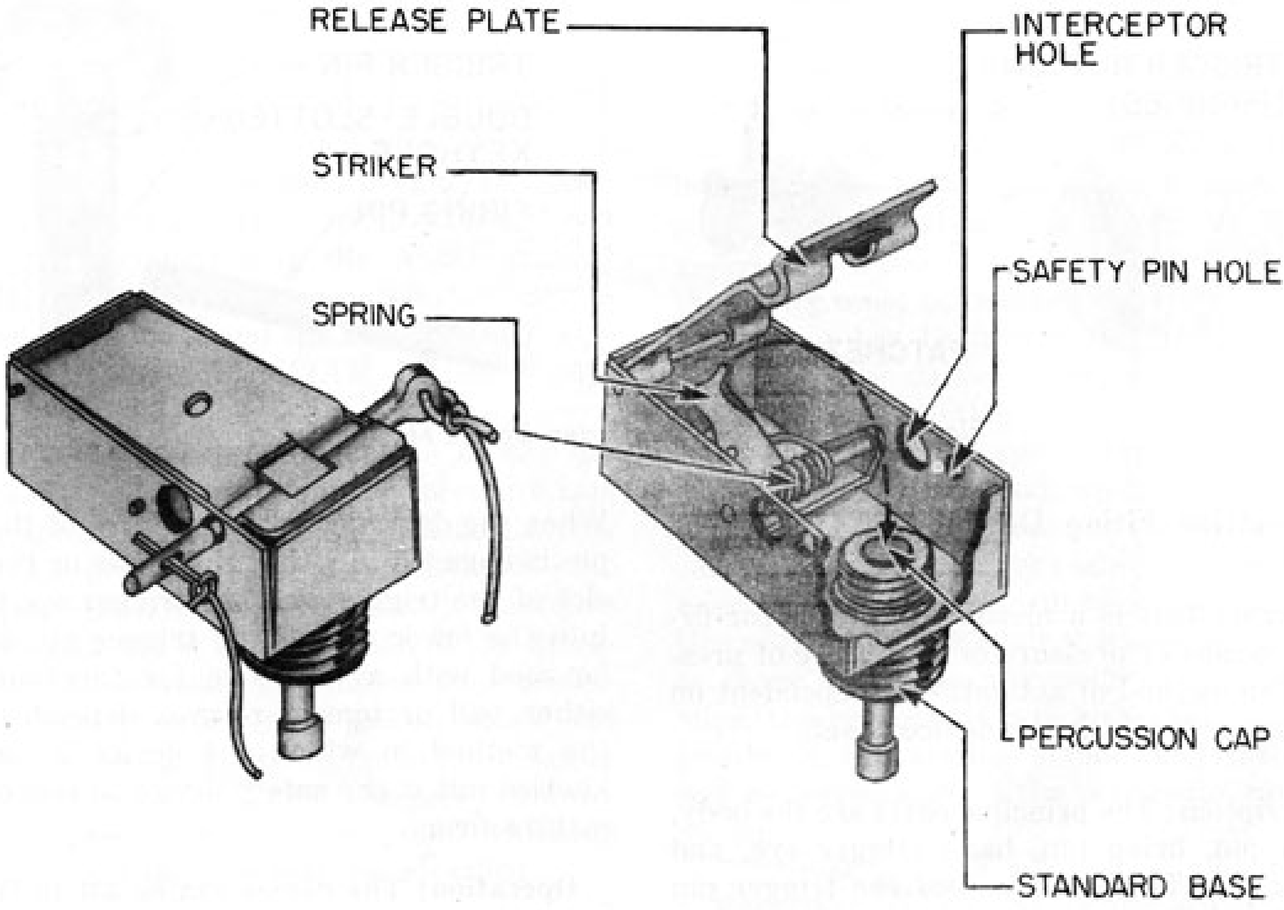


Figure 249. Release Firing Device M5

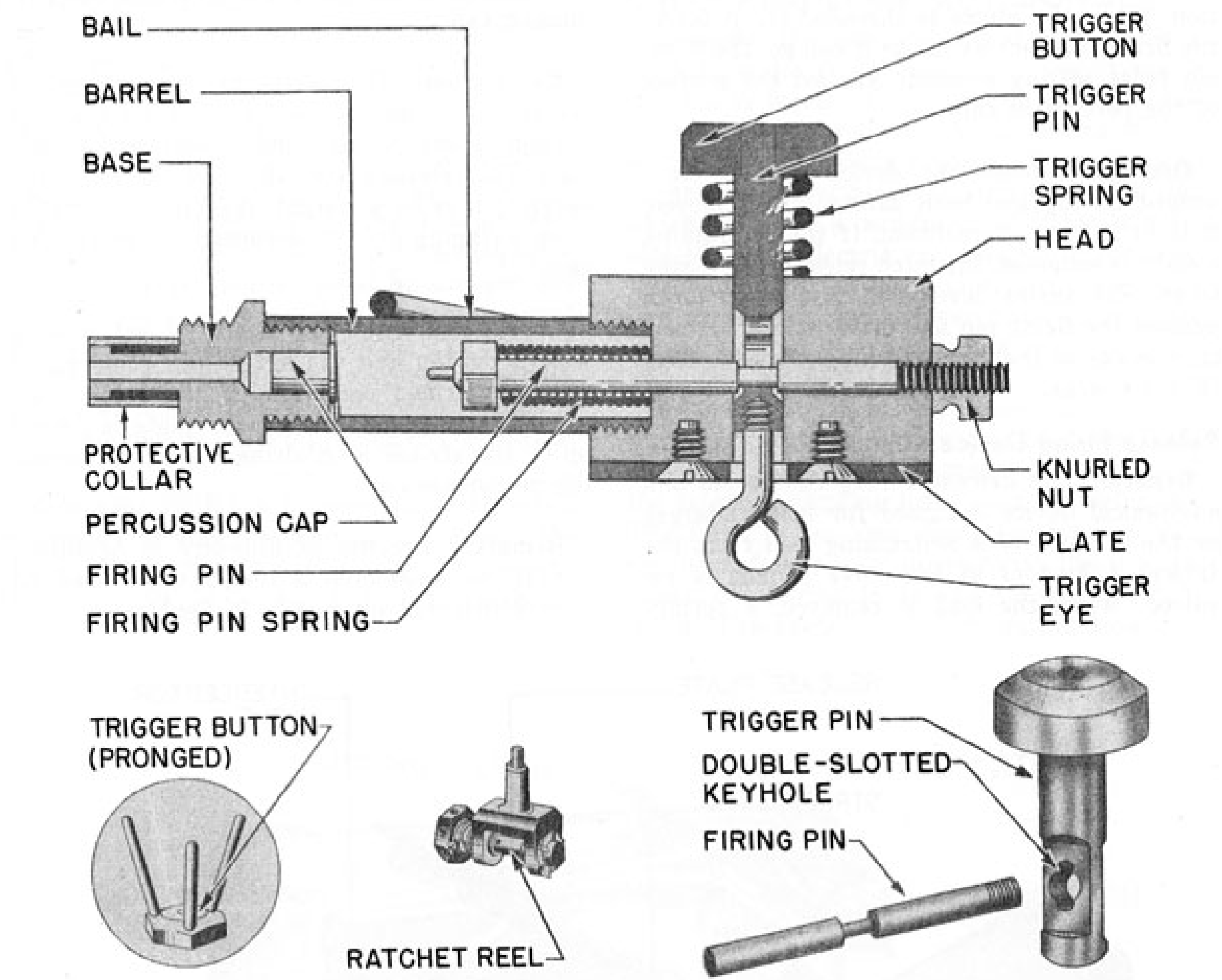


Figure 250. Combination Firing Device Mk 1 Type

Combination Firing Device Mk I Mods 0 and I

General: This is a mechanical device for firing by means of pressure or by release of pressure. The method of activation is dependent on the manner in which the device is set.

Description: The principal parts are the body, trigger pin, firing pin, base, trigger eye, and knurled nut. The projection of the trigger pin extending down into the body has two slots with an inter-connecting hole which is large enough to permit the firing pin to pass through. When the device is set, the groove of the firing pin is engaged in either the upper or the lower slot of the trigger pin. The trigger eye threads into the lower end of the trigger pin and can be used with a trip wire for functioning by either pull or tension-release, dependent upon the method in which the device is set. The knurled nut is the safety device to prevent premature firing.

Operation: The device can be set to function either by pressure and pull or by pressure release and tension release. The method of actuation is dependent on whether the trigger pin

is in the "out" or "depressed" position. The trigger pin is moved until the hole is moved in line with the firing pin and releases it. The cocked firing pin is driven on to the percussion cap by the firing-pin spring.

Mk 1 Mod 1: Installation and operation of the Firing Device Mk 1 Mod 1 is similar in all respects to the Firing Device Mk 1 Mod 0. Construction differences are as follows: The barrel, head, and plate are die-cast in one piece. A cotter safety pin passes through the barrel between the firing pin and the primer. (This cotter pin is removed after the safety nut has been threaded off. If the pin does not come out easily, the firing pin may have been released.) The trigger eye has been replaced by a removable ratchet reel, so that more accurate adjustment of the trip or tension wire is possible. A three-pronged trigger button is shipped with the device, which may be substituted for the regular trigger button. Actuating pressures for the Firing Device Mk 1 Mod 1 range from 11 to 16 pounds.

Combination Firing Device M1 (Obsolescent)

General: The Combination Firing Device M1 is designed for firing explosive charges either by means of a trip wire or by pressure. When the device is employed in the Anti-Personnel Mine M2 or M3, an igniter or blasting cap is attached to the base and the assembly is designated Fuze, Mine, M2; M2A1; M3; or M3A1.

Description: The principal parts of the device are the body, striker spindle, pressure cap, locking screw, release pin, and standard nipple base. The pressure cap is press-fitted onto the top of the striker spindle, which extends into the body and is under tension of the firing-pin spring. The striker spindle has a circumferential groove to receive the locking screw and release pin, and is drilled to receive the safety pin below the pressure cap. The base, containing the primer, has an extension to which an igniter or blasting cap may be attached.

Modification: Bending beyond seven degrees has caused the striker spindle to break at the point of the groove. To correct this defect, later productions will have the safety pin 1/8 inch to 3/16 inch below the point of the assembled firing pin instead of through the top portion of the striker spindle.

Anti-Personnel Mine M2: When the Firing Device M1 is employed in this mine, an igniter is attached to the base and the assembly is designated Fuze, Mine, Anti-Personnel, M2. The Fuze M2 as modified with the safety pin below the striker spindle is designated Fuze, Mine, Anti-Personnel, M2A1.

Anti-Personnel Mine M3: When the Firing Device M1 is employed in this mine, a blasting cap is crimped to the base and the assembly is designated Fuze, Mine, Anti-Personnel, M3. The Fuze M3 as modified with the safety pin below the striker spindle is designated Fuze, Mine, Anti-Personnel, M3A1.

Operation: When the igniter or blasting cap has been attached to the base and inserted in the charge, the locking screw is backed off so that it is no longer engaged in the groove in the striker spindle. The safety pin is then removed. If the safety pin binds, it is quite possible that the release pin is not properly engaged in the groove in the arming spindle, and the device must be checked carefully. When the safety pin has been removed, the only thing preventing the striker spindle from being forced toward the percussion cap by its spring is the release pin, which is spring loaded inward. The device is now armed and can be fired either by pressure on the pressure cap or by pull on the release ring. If over 20 pounds of pressure is exerted on the cap, it will be sufficient to force the release pin out against its spring; if a pull of three to six pounds is exerted on the trip wire, the release pin will be pulled free of the groove in the arming spindle and the striker will be forced against the percussion cap by its spring.

Remarks: This firing device is used almost exclusively with the Anti-Personnel Mines M2 and M3.

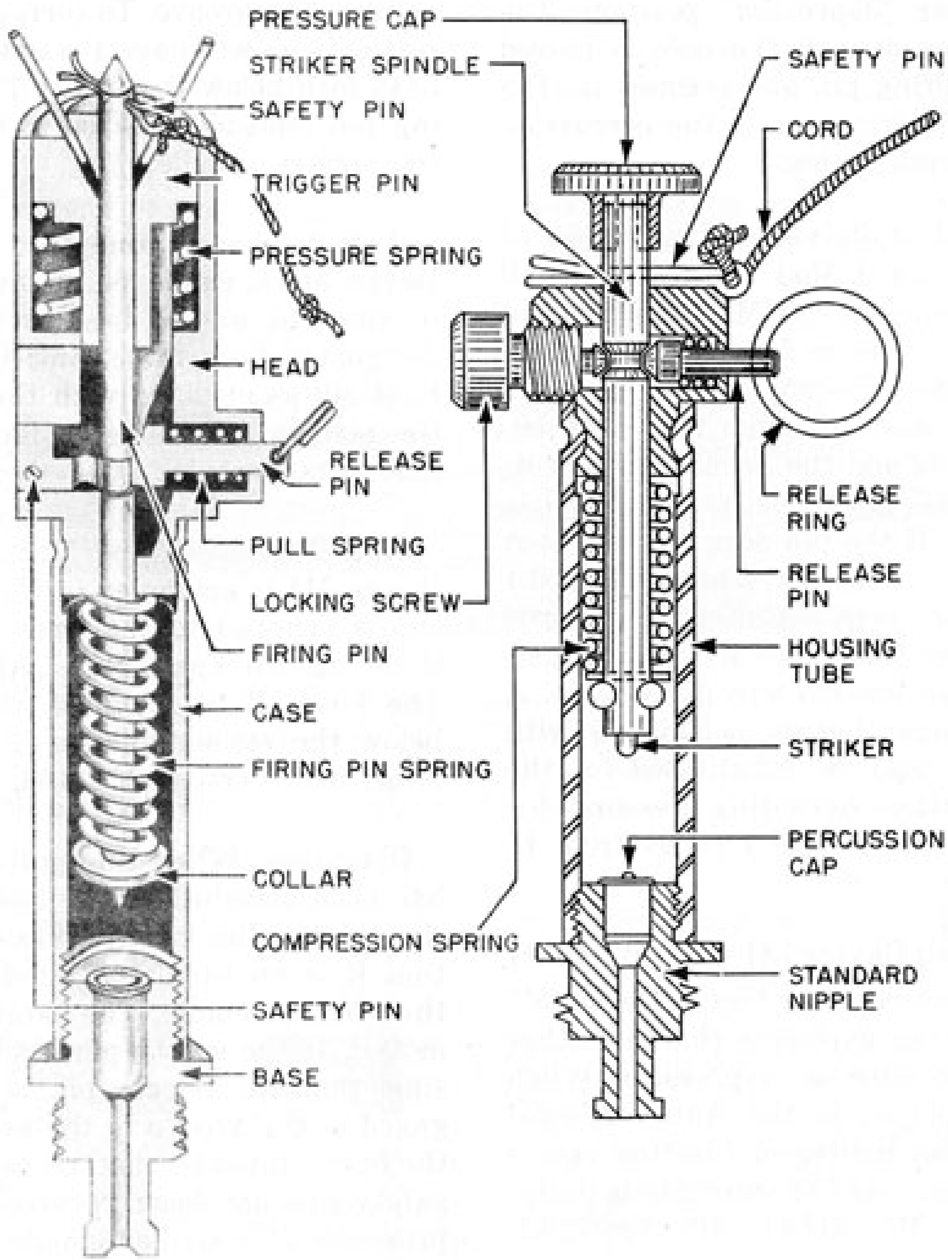


Figure 251. Combination Fuze M6 (left) and Combination Firing Device M1 (right)

Combination Fuzes M6 and M7

General: The combination fuzes M6 and M7 are designed for firing explosive charges either by means of a trip wire or by pressure. The mechanical construction of the fuzes is similar, but they differ in the loading of the base plug.

The M6 is 6.6 inches in length, and the threaded portion of the base is ½ inch long; the M7 is 7.13 inches in length, and the threaded portion of the base is ¼ inch long. The igniter charge of the Combination Fuze M6 consists of 10 grains of black powder, while the detonator of the M7 consists of a U. S. Army Special, Type A, blasting cap.

Description: The fuze consists of a head and case crimped together, which contain a trigger pin, a release pin, and a firing pin, each with a spring. A small groove in the firing pin is held in the narrow part of a keyhole slot in the release pin, the release pin being provided with a ring for attaching trip wires. The trigger pin has three one-inch-long prongs of stiff steel wire projecting from its head. A wedge is provided on the bottom of the trigger pin which

enters a slot in the release pin. When sufficient pressure is applied to one or more prongs, the release pin is moved aside and the firing pin passes through the large opening of the key-hole slot. Two safety pins are provided, one passing through the firing pin and the other passing through the release pin. The base is a hollow cylinder which contains the primer.

Use: The Combination Fuze M6 can be used in the Anti-Personnel Mines M2A1, M2A2, M2A3, or M2A3B2. The Combination Fuze M7 is used in the Anti-Personnel Mine M3.

Operation: When the fuze is armed, either a pull on the release-pin ring of 6 to 10 pounds or a pressure of 10 to 20 pounds on the three prongs (10 to 30 pounds on one prong), depressing the trigger pin 9/32 inch, will move the release pin 3/32 inch, so that the larger hole is in line with the firing pin. The firing pin is thereby released, and the compressed firing-pin spring will drive the striker down on the percussion cap.

Remarks: The Combination Fuzes M6 and M7 replaced the Combination Fuzes M2, M2A1, M3, and M3A1 in the Anti-Personnel Mines M2 and M3 Series.

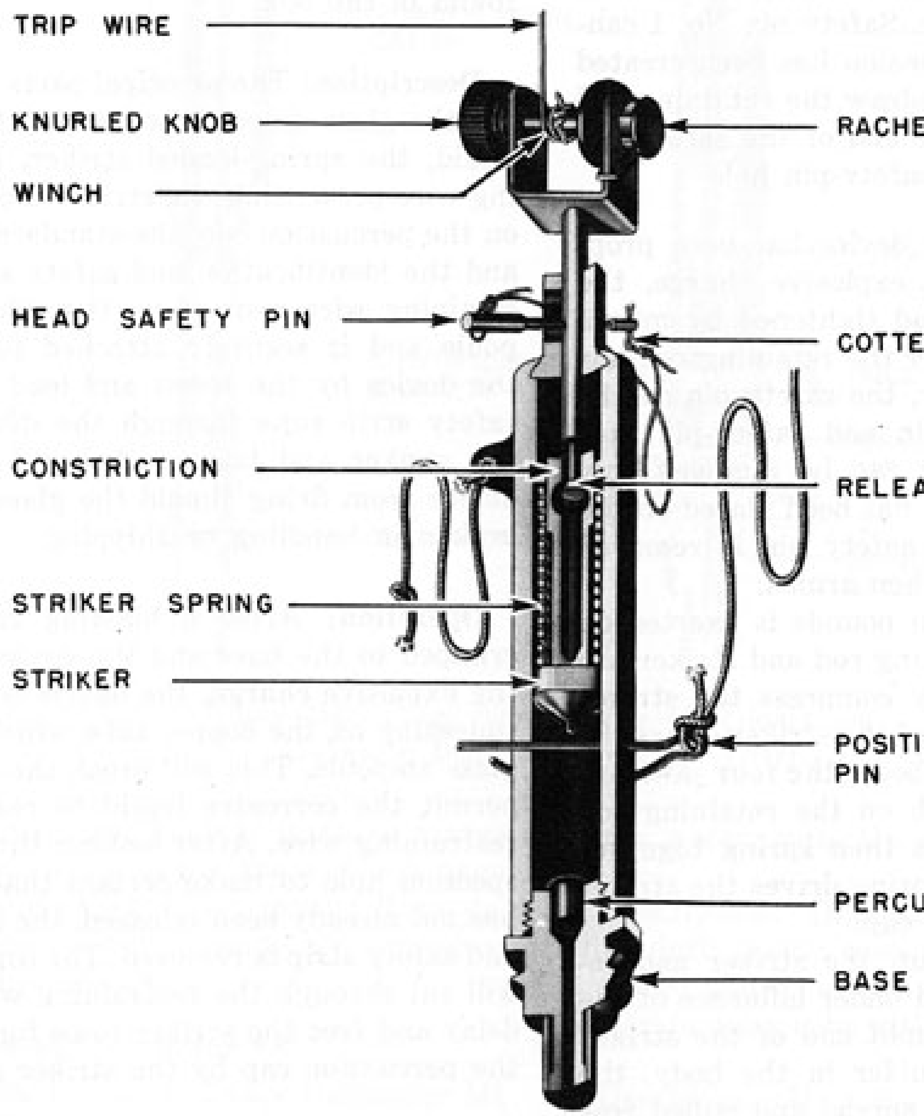


Figure 252. Tension and Release Device M3

Tension and Release Firing Device M3

General: This device is specially designed to be used with a trip wire. Unlike the standard pull firing device, the Firing Device M3 must have the trip wire tightly stretched, so as to exert considerable tension on the retaining rod. The device can be activated by tripping, or by cutting the trip wire.

Description: The parts are the body, ratchet reel, retaining rod, striker spring, striker, two safety pins, and standard nipple base. The striker has a split base, forming four jaws which engage the nib on the end of the retaining rod. The ratchet provides a convenient method for tightening and creating the desired tension on the trip wire. Safety pin No. 1 cannot be removed until tension has been created on the trip wire to withdraw the retaining rod sufficiently for the large end of the safety pin to clear the elongated safety-pin hole.

Operation: When the device has been properly installed with the explosive charge, the trip wire is attached and tightened by means of the ratchet reel. After the retaining rod has been withdrawn slightly, the safety pin can be removed. The safety pin and safety-pin hole are so designed that it can be removed only after the proper tension has been placed on the trip wire. The positive safety pin is removed last, and the device is then armed.

If a pull of six to ten pounds is exerted on the trip wire, the retaining rod and striker are pulled back and thereby compress the striker spring. As the split end of the striker clears the internal shoulder in the body, the four jaws are forced open and the nib on the retaining rod is pulled free. The jaws then spring together again, and the striker spring drives the striker down on the percussion cap.

If the trip wire is cut, the striker and retaining rod move inward under influence of the striker spring. As the split end of the striker clears the internal shoulder in the body, the jaws of the striker are spread and pulled free of the nib on the retaining rod by the striker spring, which then forces the striker down on the percussion cap.

Remarks: The device must be securely anchored to enable tension to be placed on the trip wire without dislodging the device or explosive charge.

Delay Firing Device M1

General: This device is designed for firing explosive charges by chemical delayed action. They are issued in boxes of ten, with different delays. The delay depends on the concentration of the corrosive liquid in the glass ampoule, the color of the safety tab on each device indicating the delay of that device. In addition, the delay varies with the temperature. A chart with the temperature correction for each device will be found in the box.

Description: The principal parts of the device are the glass ampoule containing the corrosive liquid, the spring-loaded striker, the restraining wire preventing the striker from impinging on the percussion cap, the standard nipple base, and the identification and safety strip. The restraining wire runs along the side of the ampoule and is securely attached to the end of the device by the screw and lead washer. The safety strip runs through the device between the striker and base, and would prevent the device from firing should the glass ampoule be broken in handling or shipping.

Operation: After a blasting cap has been crimped to the base and the device inserted in the explosive charge, the device is actuated by squeezing on the copper tube which houses the glass ampoule. This will break the ampoule and permit the corrosive liquid to react upon the restraining wire. After looking through the inspection hole to make certain that the striker has not already been released, the identification and safety strip is removed. The corrosive liquid will eat through the restraining wire after the delay and free the striker to be forced down on the percussion cap by the striker spring.

Remarks: If it is absolutely necessary to disarm, insert the safety pin through the inspection holes.

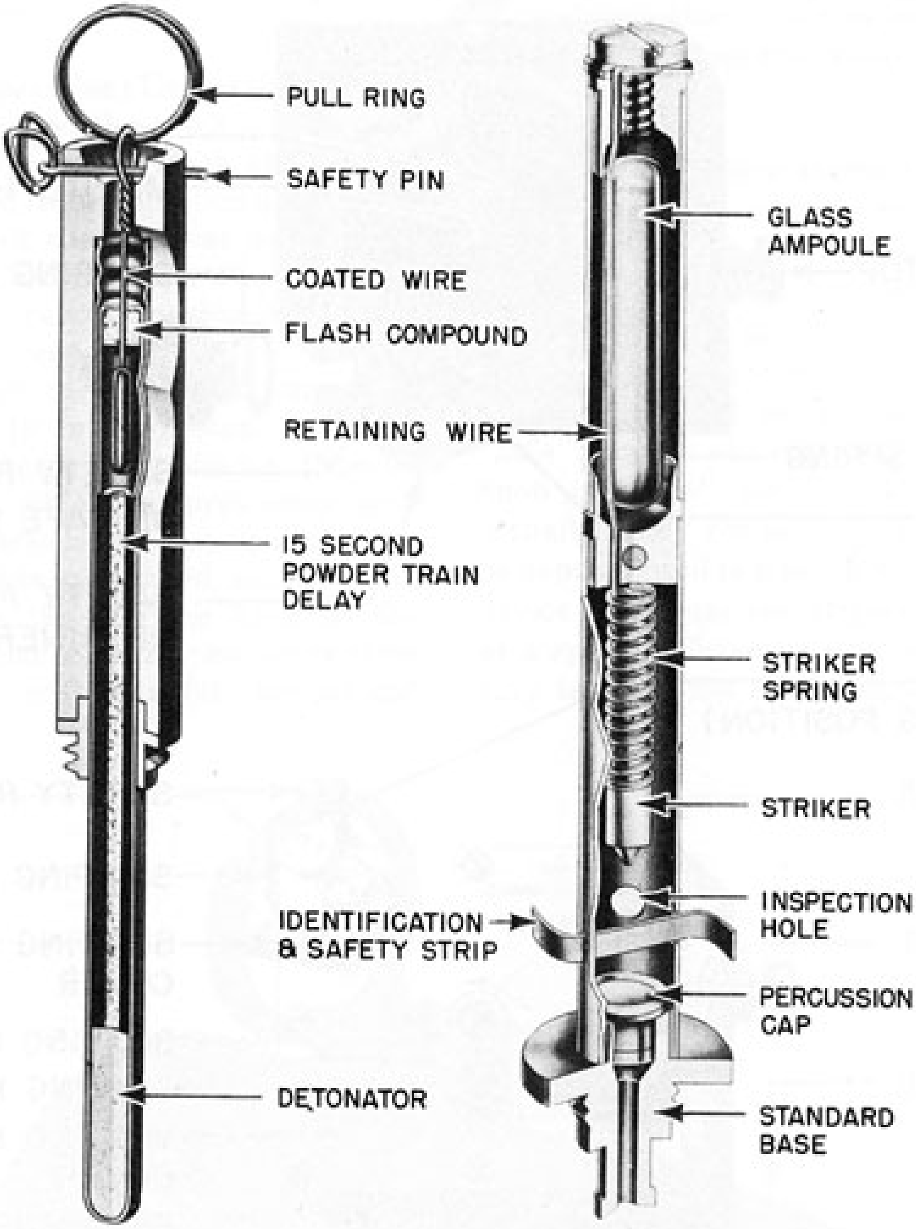


Figure 253. Delay Firing Device M1 (right) and 15–Second Delay Detonator M1 (left)

Troops must not approach an installed charge employing this delay fuze. Areas where they have been installed should be marked. Time delay starts when the tube is squeezed, not when the safety tab is withdrawn.

15-Second Delay Detonator M1

General: The 15-Second Delay Detonator M1 does not use the standard nipple, nor is it used with a blasting cap. It is used to obtain delay in firing demolition charges, particularly during assault demolitions. It can be used to fire charges under water, since the case is waterproof.

Description: This detonator consists of an olive drab plastic case, a pull ring attached to a coated pull wire, flash compound, and a powder-train delay tube with a detonator at the end.

Operation: When the safety pin is removed, a jerk on the pull ring draws the coated wire through the flash compound. The resultant flash ignites the powder-train delay, which sets off the detonator 15 seconds later.

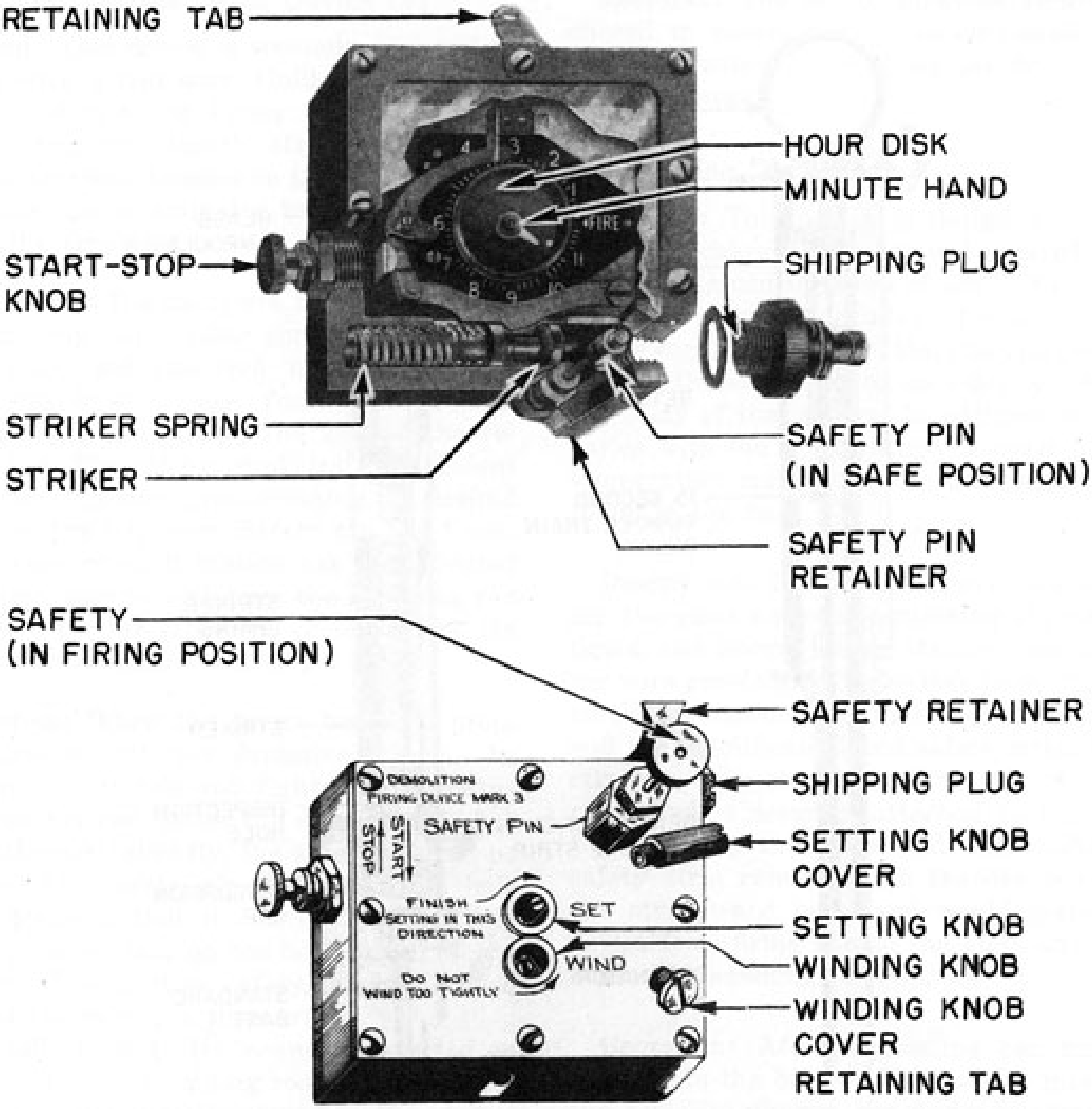


Figure 254. Demolition Firing Device Mk 3

Remarks: The pull ring should be jerked sharply. Once the pull ring has been jerked, there is no way to stop the detonator from exploding.

Demolition Firing Device Mk 3 (Obsolete)

Length, inches 2.5
Width, inches 2.37
Thickness, inches 1.37

Description: Essentially, the Demolition Firing Device Mk 3 consists of an ordinary watch movement in which the hour hand is replaced by a cup which is slotted on the outside rim, a release mechanism which carries a bar that rides on the edge of the cup so that the release mechanism will operate as soon as the bar can enter the slot, and a firing pin. The device is waterproof to a depth of 20 feet. Time delay is adjustable up to 11½ hours, with a minimum allowable setting of ten minutes. The luminous dial indicates the time remaining before the device fires; the luminous dot on the slotted cup coinciding with the number of remaining hours,

and the luminous hand indicating the number of remaining minutes.

Installation and operation: Unscrew the winding-knob cover and wind the clock in a normal manner. Unscrew the setting knob and set the clock to the desired time, observing the precaution that the clock should never be set for a delay of less than ten minutes. Check to see that the bar on the release mechanism is outside the rim of the cup and has not already slipped inside. Check to insure that the clock starter is completely in the "stop" position. Screw the blasting-cap firing device (Special non-electric, 11.01), which has previously been assembled to other articles such as booster, time fuse, demolition blocks, primacord, etc., onto the cap chamber. Turn the starting knob to the "start" position. Bend back the protective strip from the safety pin; pull the safety pin out and lock it in place by turning the safety-pin knob counterclockwise as far as possible. The device will then fire when the remaining time has been used up.

Precautions: Time starts running out the instant the clock is started; therefore, do not set the clock for less than ten minutes. Excessive delay in pulling the safety pin after the clock is started will not allow a sufficient margin of safety for getting away. Do not attempt to reset the clock without having the safety pin in the "safe" position and without having the starting knob in "stop" position. Until the device is actually ready for use, the shipping plug must be kept screwed in place. Premature firing of the device will cause the striker to be thrown out at a speed sufficiently high to cause serious injury to personnel and equipment.

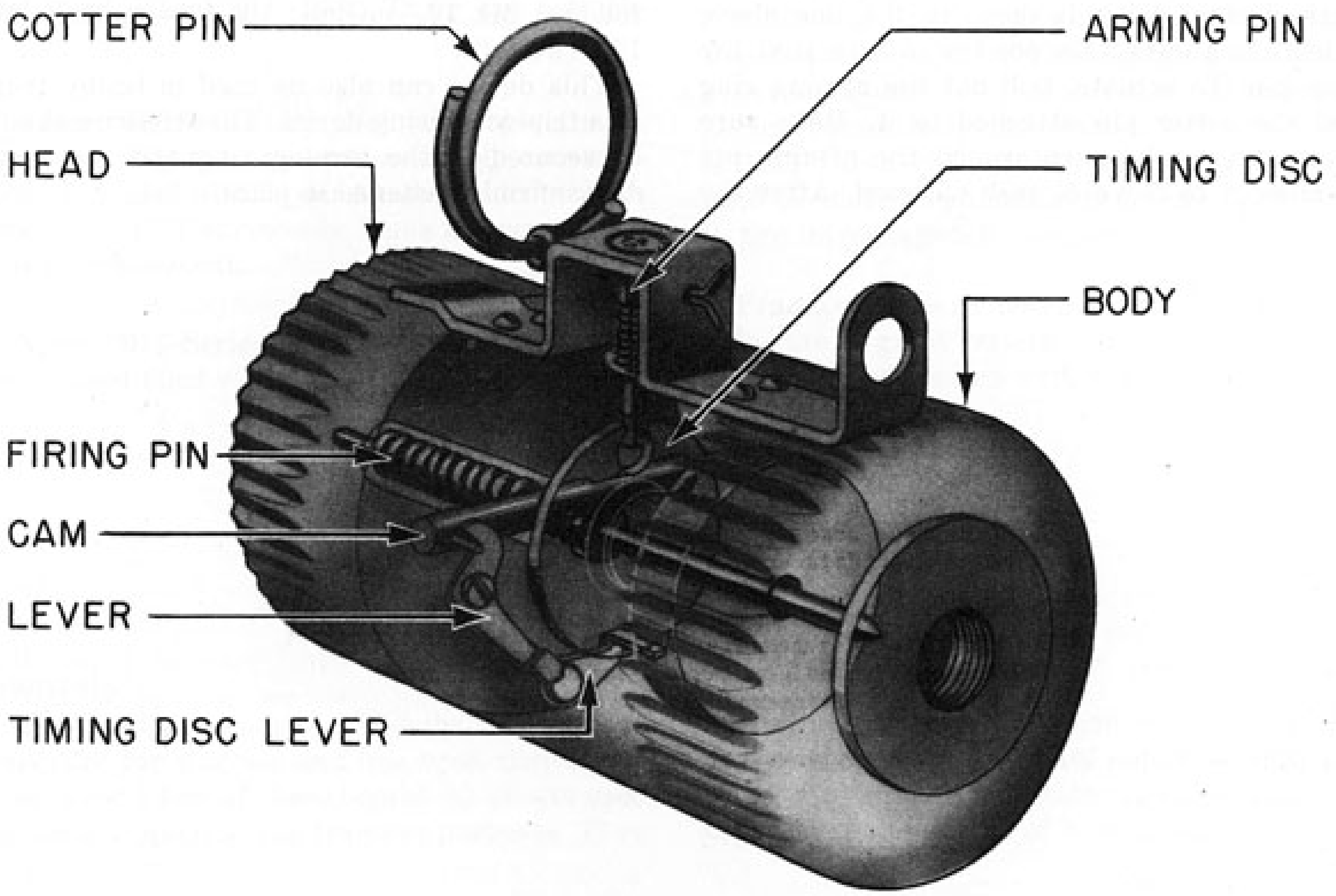


Figure 255. Demolition Firing Device Mk 15 Mod 0

Demolition Firing Devices Mk 15 Mod 0, Mk 12, and Mk 13

General: These devices are clockwork mechanisms designed to fire demolition charges with a time delay, adjustable—depending upon the model—from five seconds to eleven hours. They are designed for firing either activator-well, or detonating-cord charges.

Description: The principal parts of this series are the body, head, timing disc, timing-disc lever, cam, firing pin, arming pin, and cotter pin.

Setting and actuation: The Mk 12 may be set from 5 to 90 seconds delay; Mk 13, from 1 minute to 1 hour delay; Mk 15, from ¼ to 11 hours delay. Because the Mk 15 is as much as 30% inaccurate for settings beneath one hour, these calibrations are coated with red paint as a warning.

To set, turn the head of the device until the desired time delay is opposite the line above "Delay in Hours." Do not try to turn past the stop pin. To actuate, pull out the arming ring and the cotter pin attached to it. Make sure there is enough space around the arming pin to allow it to move ⅜ inch outward. After the device is actuated, it cannot be stopped.

Operation: When the cotter pin is removed, the spring-loaded arming pin moves out of the notch in the timing disc. The timing disc, driven by a pre-wound clock movement, can then revolve until the notch meets the timing-disc lever. The lever position and, therefore, the elapsed time, is changed by rotating the head to the desired time setting. A spring-loaded firing pin, positively locked in place by a series of cams and levers, is released when the timing-disc lever enters the notch. The firing pin penetrates the waterproof diaphragm and fires the percussion cap. The flash of flame which results will detonate the Special Non-electric Cap or the Detonating Cord Initiator Mk 2 Mod 0.

Remarks: Tabs have been placed under the screws fastening the head to the body, to make possible identification by feel in the dark, as follows: Mk 12—no tab; Mk 13—one tab; Mk 15—two tabs.

This device can also be used in booby traps as a trip-wire firing device. The trip wire should be secured to the arming ring and the firing device firmly fastened in place.

Part 6

BOMBS AND BOMB FUZES

Chapter 17 — EXPLOSIVE BOMBS

Section 1 — INTRODUCTION

Classification

In this chapter, the bombs have been categorized according to the series in which they were developed. The fundamental characteristics of each series are as follows:

Army "Modified Mark" Series; Streamlined and filled with 100% TNT. These are now obsolete.

Army "M" Series: Parallel sides, ogival nose, and boat tail; box type-tail assembly construction; and filled with 50/50 Amatol sealed at both ends with TNT surrounds. Some are now classified as obsolescent.

Navy "Mk" Series: Similar to design of Army bombs and filled with 100% TNT; discontinued, with some exceptions, under the standardization program.

Army-Navy "AN" Series: Similar to the "M" Series, except: (1) third suspension lug added at center of gravity and 180° removed from other two lugs, and (2) base plate changed to the male type.

Since the development of the "AN" series, there have been two further modifications of the general-purpose (G.P.) bombs within that series, successively the "AN–G.P." and "AN–G.P.A1" modifications. The changes characteristic of these two modifications are dealt with in the introduction to Section 5.

Practice bombs: These dummy and special designs are of great variety and have probably received more attention with the advent of peace.

Part 6 — Chapter 17 — Section 2

ARMY "MODIFIED MARK" SERIES (OBSOLETE)

General

This particular series of bombs was not satisfactory for war use and has been abandoned, except for a few of these bombs which are used for target practice and training purposes. They are all of the same type and are intended for the same target use, general bombardment. The accompanying chart contains the essential data concerning the bombs of this series.

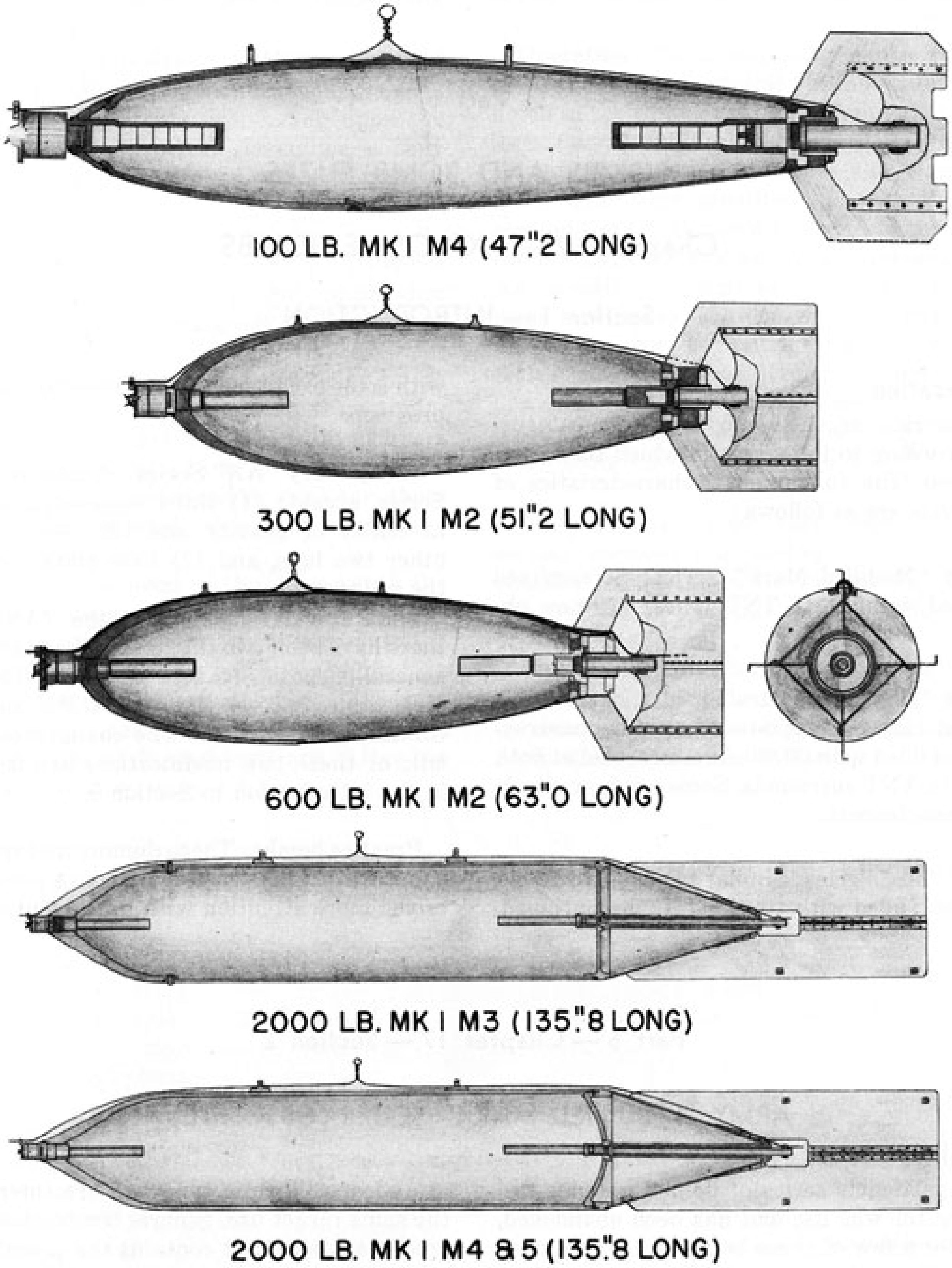


Figure 256. Army "Modified Mark" Series Bombs

U. S. ARMY "MODIFIED MARK" SERIES BOMBS

Bombs	100-lb. Mk I MIV	300-lb. Mk I MII	600-lb. Mk I MIII	1,100 lb. Mk III MI	2,000-lb. Mk I MIII & MIV	2,000-lb. Mk I MV
Fuzes	Nose: M105			Tail: M106		
Overall length	47.2″	51.2″	63.0″	68.5″	135.8″	
Length of body	39.5″	40.6″	52.2″	61.6″	97.0″	
Body diameter	7.9″	12.2″	16.5″	20.8″	18.5″	
Wall thickness	0.16″	0.12″	0.2″	0.15″	0.50″	
Wall material	Steel					
Length of tail	8.5″	12.0″	14.0″	33.5″	49.2″	
Width of tail	11.0″	15.0″	20.5″	28.5″	26.1″	
Material of tail	Sheet steel				Sheet steel with cast-steel tail cone	
Weight of tail	2.6#	6.1#	5.0#	55.0#	140.0#	
Type of filling	Cast TNT					
Weight of filling	65.0#	148.0#	355.0#	650.0#	960.0#	
Total weight	119.4#	285.9#	611.0#	1175.0#	1920.0#	1830.0#
Charge/weight ratio	54.5%	52.0%	58.0%	55.3%	50.0%	52.4%
Body construction	Streamlined body formed by welding three cast-steel sections together				Cast-steel nose riveted to seamless steel tubing; rear not tapered	Seamless steel tubing
Tail construction	A cast-steel sleeve secured to body by a fin locking nut; four fins or vanes; internal box-type struts			Four vanes with bar struts, attached to body by screws	Four vanes riveted to tail cone; two sets of external bar struts to reinforce vanes; cone secured to flange on base plate	
Construction of suspension	Two U-shaped bar-steel eyebolts welded to body along longitudinal axis				Two U-shaped eyebolts on plates secured to body by cap screws	
Type of suspension	Horizontal					
Color and markings	Prior to March 11, 1942, these bombs would have been yellow all over with black manufacturers' markings; but since that date will be olive-drab with one-inch yellow bands around nose and base and a ¼-inch band around center of gravity.					

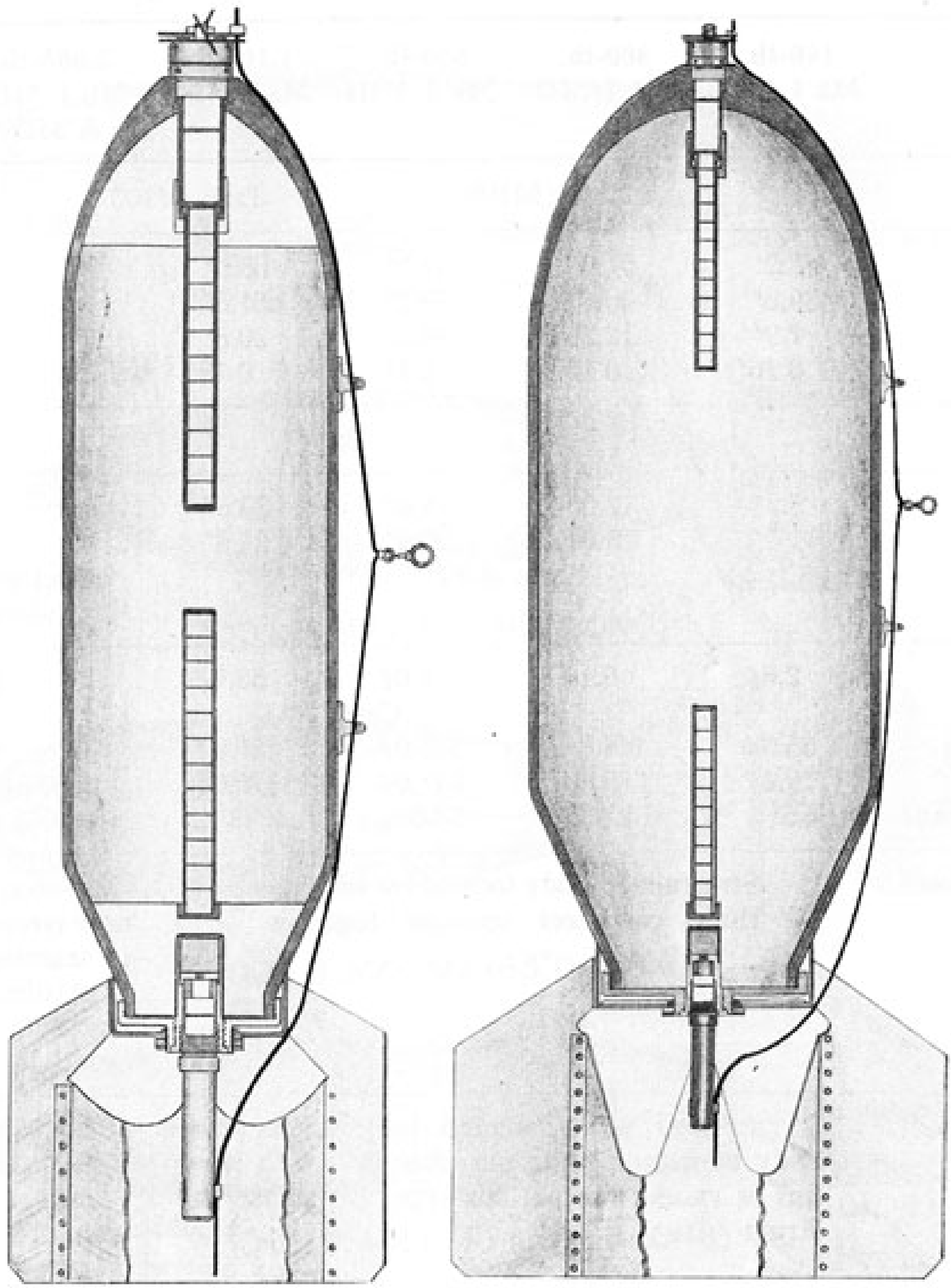


Figure 257. "M" Series Demolition Bombs—600-pound M32 (left) and 1,100-pound M33 (right)

"M" SERIES

Introduction

Prior to the organization of the AN Standardization Board in 1941, these bombs were designated as "Demolition H.E." bombs; under the standardization policy they were retitled as "General-Purpose High-Explosive (G.P.H.E.)" bombs.

Targets: Ammunition dumps, railway engines, and cars, all types of construction, and aircraft on the ground.

Body construction: These bombs may be made by any one of the following methods: (1) From seamless steel tubing in which the nose of the bomb is formed by swaging and the tail by drawing to the necessary diameter; or (2) the case may be forged in one piece; or (3) it may be formed from cast sections welded together. These bombs have female base filling plates.

Type of suspension: Horizontally, by dual lugs.

Construction of suspension lug: Two eyebolts welded to body along the longitudinal axis of the bomb. The eyebolts are formed from bar steel, shaped in the form of a U, and then welded to the body.

Color and markings: Prior to 11 March, 1942, these bombs would have been painted yellow all over, with black manufacturer's markings; since that date they have been painted olive drab with a one-inch yellow band around the nose and base and a ¼-inch band around the center of gravity.

Material of tail: Sheet steel.

Tail construction: This type of tail consists of the following parts: (1) a cast-steel sleeve secured to the body of the bomb by a fin-locking nut; (2) four fins or vanes; and (3) internal box-type struts. One vane and one strut are pressed from one piece of metal, and the four pieces are welded to one another and to the sleeve.

Type of filling: (1) 50/50 Amatol. Since Amatol is hygroscopic, TNT surrounds are placed around the nose and tail booster sleeves to seal the Amatol from moisture; (2) 100% TNT, which will be stencilled on the bomb. All of this series except the 100-pound M30 contain two built in Auxiliary Boosters M104, one in the nose and one in the tail, which contain tetryl. The 100-pound M30 has the auxiliary booster in the nose only. The Adapter Booster M102 (tetryl) is threaded to the base plate of all bombs in the series and receives the tail fuze.

Other bombs that carry an "M" designation, although not actually classified in the "M" series, are included in this section because they are obsolescent:

M62	600-pound	A.P.–H.E.
M61	800-pound	A.P.–H.E.
M60	900-pound	A.P.–H.E.
M52	1,000-pound	A.P.–H.E.
M63	1,400-pound	A.P.–H.E.
M5	30-pound	Frag. (Obsolete)

"M" SERIES DEMOLITION

Bombs	100-lb. M30		300-lb. M31	
Over-all length	36.0″		48.6″	
Length of body	30.0″		40.2″	
Diameter of body	8.2″		10.9″	
Thickness of wall	0.16″		0.27″	
Length of Tail	9.75″		12.1″	
Width of tail	11.0″		14.9″	
Weight of tail	3.5#		6.0#	
Filling	Amatol 50/50	TNT	Amatol 50/50	TNT
Weight of filling	53.3#	54.0#	135.5#	137.0#
Total weight	106.3#	107.0#	272.5#	274.0#
Charge/weight ratio	50.1%	50.6%	49.4%	50.0%
Fuzing	These bombs take the Fuze M103 in the nose			

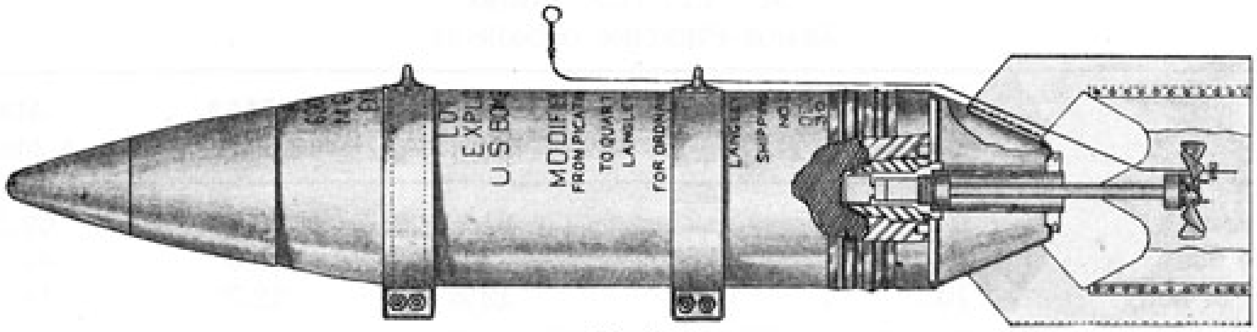
"M" A.P.–H.E. Bombs
Armor-Piercing (Obsolete)

Bombs	M62 600-lb.	M61 800-lb.	M60 900-lb.	M52 1,000-lb.	M63 1,400-lb.
Over-all length	62.1″	58.7″	61.7″	70.9″	69.1″
Length of body	46.9″	38.6″	41.3″	50.0″	45.7″
Diameter of body	10.1″	12.4″	12.2″	12.3″	14.3″
Wall thickness	—	—	—	2.3″	—
Length of tail	17.5″	22.7″	22.76″	22.76″	24.0″
Width of tail	13.8″	16.6″	16.6″	16.6″	19.6″
Weight of tail	15.12#	22.4#	22.4#	21.0#	—
Filling	Explosive D	Explosive D	Explosive D	Explosive D	Explosive D
Weight of filling	33.61#	32.68#	43.34#	58.35#	35#
Total bomb weight	634.0#	853.0#	889.0#	1,077.0#	1,412.0#
Charge/weight ratio	5.5%	3.8%	4.8%	5.4%	2.5%

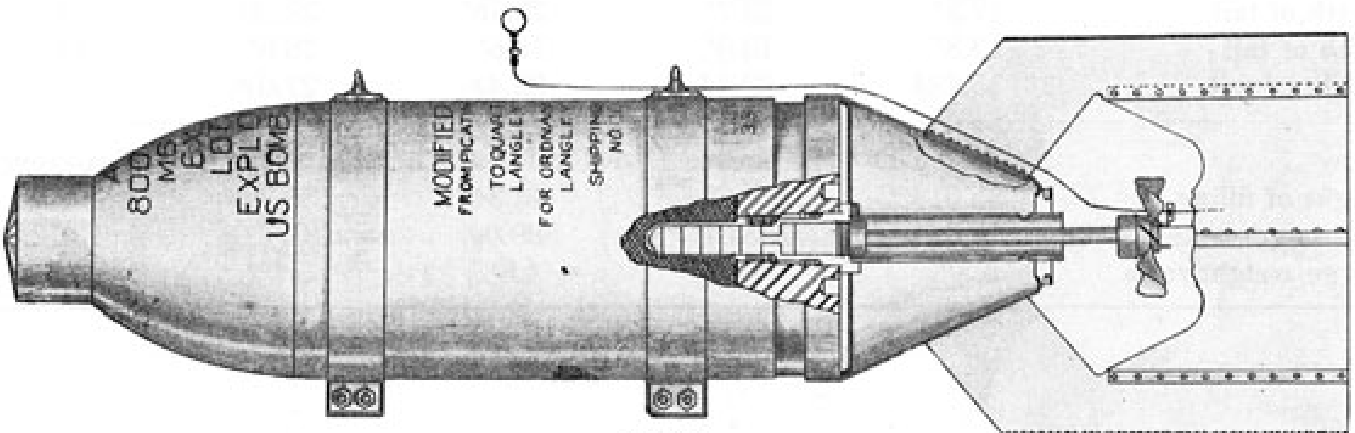
Bombs (Obsolescent)

600-lb. M32		1,100-lb. M33		2,000-lb. M34	
59.5″		68.7″		90.4″	
49.5″		54.7″		70.0″	
15.2″		19.8″		23.3″	
0.35″		0.43″		0.5″	
13.9″		18.5″		25.7″	
20.4″		27.0″		31.6″	
12.6#		22.5#		38.6#	
Amatol 50/50	TNT	Amatol 50/50	TNT	Amatol 50/50	TNT
319.3#	336.0#	588#	618#	1,061#	1,077#
586.5#	621.0#	1,111#	1,141#	1,971#	1,987#
54.4%	54.1%	52.9%	54.1%	53.8%	54.7%

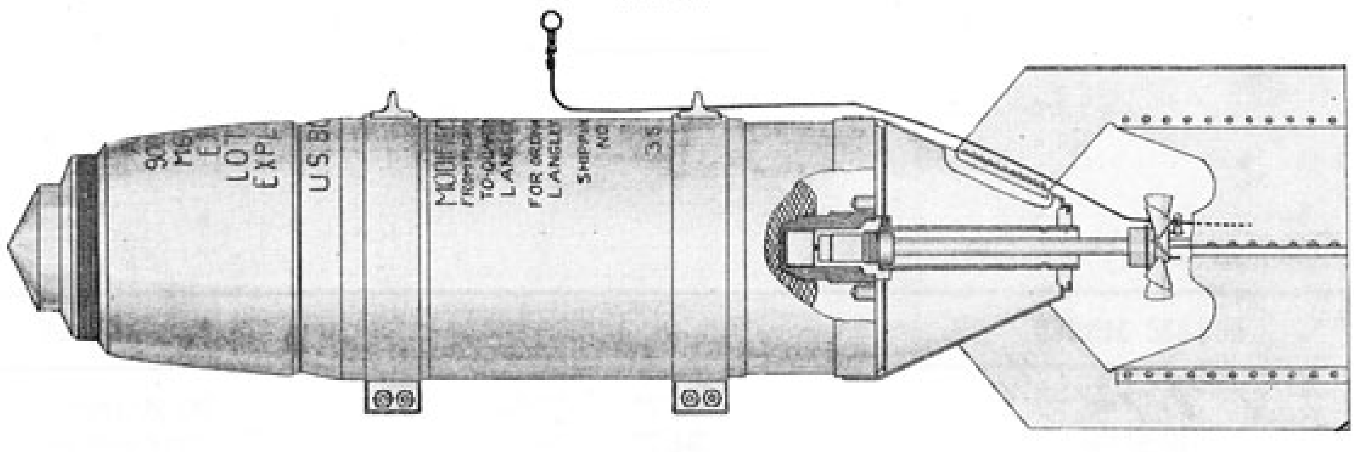
and the Fuze M106 in the tail.



M 62



M 61



M 60

Figure 258. "M" Series A.P. Bombs

Characteristics of "M" Designated A.P. Bombs

Target: Armored naval craft, reinforced concrete, heavy steel construction.

Fuzes: M102 or AN–M102, including A1 and A2 modifications.

Body construction: These bombs are converted seacoast artillery shells from which the rotating bands may have been removed. The cases are single-piece steel forgings. The modifications of the M52 and M62 differ only slightly in external dimensions and are all equipped with a nose cap for streamlining.

Construction of tail: A truncated tail cone is secured to the bomb base by a locking nut at the top of the fuze body; four fins or vanes are supported by internal box-type struts.

30-pound Frag. M5 (Obsolete)

Over-all length, inches	25.5
Body length, inches	13.05
Body diameter, inches	4.2
Wall thickness, inch	0.6
Tail width, inches	6.5
Type of filling	TNT
Weight of filling, pounds	4.66
Total weight, pounds	29.8
Charge/weight ratio	16.3%
Fuzing	Mk XIV

Body construction: The body consists of a seamless steel tube over which are fitted rings cut from cast-steel pipe. Cast-steel nose and base pieces thread onto this center tube.

Suspension: The bombs may be suspended horizontally, vertically, or in a cluster. U-shaped eyebolts are welded to the bomb at the center of gravity and to the rear of the tail. Later issues of bombs were in the Cluster M3, which contained six 30-pound Frag. Bombs M5.

Tail construction: Four rectangular sheet-steel vanes are welded to a length of one-inch cast-iron pipe that screws into the base filling plug.

2,000-pound S.A.P. M103

Over-all length, inches	89.29
Body length, inches	68.5
Body diameter, inches	18.63
Wall thickness, inches	1.3
Tail length, inches	25.6
Tail width, inches	25.8
Tail weight, pounds	52.7
Filling	Picratol
Weight of filling, pounds	556
Total weight, pounds	2,039
Charge/weight ratio	27%

Fuzing: Unlike smaller S.A.P. bombs, the M103 has a solid nose, permitting tail fuzing only.

REGULAR MISSIONS—AN–M102A2, AN–M102A1, M162.

SPECIAL MISSIONS—M114, M114A1, M117 (minimum altitude bombing), M125, M125A1 (long delay), M134.

Construction: The body of the M103 is fabricated from seamless steel tubing, somewhat streamlined in shape and with a semi-pointed nose. No provision is made for nose fuzing in this bomb. Suspension lugs are welded to the case in a manner similar to the G.P. bombs. Trunnions on a band may be fitted for dive-bombing. A box-type tail is employed as on the G.P. bombs.

Filling: Picratol, a mixture of 52% Explosive "D" and 48% TNT, is poured as the main charge, with a wax pad in the nose to cushion the explosive against premature detonation on impact with a hard target. The Adapter Booster M115A1 replaces the M102A1 fitted in the S.A.P. Bombs AN–M58 and AN–M59.

Remarks: The suspension lugs are 30 inches apart. Suspension bands are under development and will be issued, when available, for installations requiring 14-inch suspension.

4-pound Frag. "Butterfly" M83

Over-all length, inches	3.0
Body length, inches	3.0
Body diameter, inches	3.1
Wall thickness, inch	0.25
Filling	TNT
Weight of filling, pound	0.47
Total weight, pounds	3.2
Charge/weight ratio	15%

Fuzing: M129 Air or ground burst, M130 Time, maximum 30 minutes, or M131 Anti-disturbance.

Body construction: The bomb body is cylindrical in shape, cast in two halves and welded together. The fuze cavity is situated athwartships in the body, is 1¾ inches in diameter, and is threaded with a left-hand thread. The left-hand thread is to prevent unscrewing of the fuze while the bomb is in flight.

Arming vane assembly: The vane assembly consists of four pieces hinged together—two semi-cylindrical surfaces (wings) and two discs (propeller blades) inclined at a slight angle.

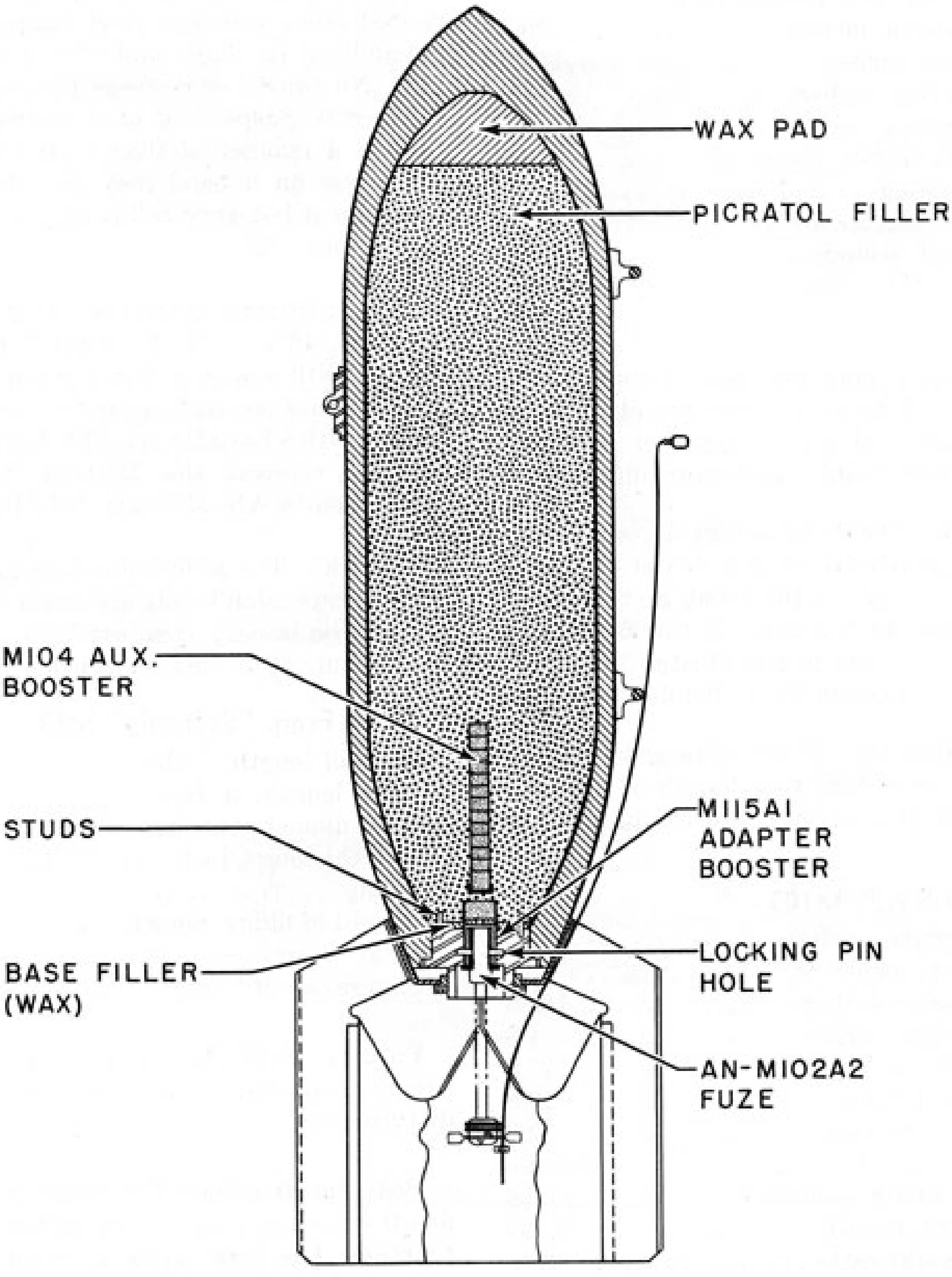
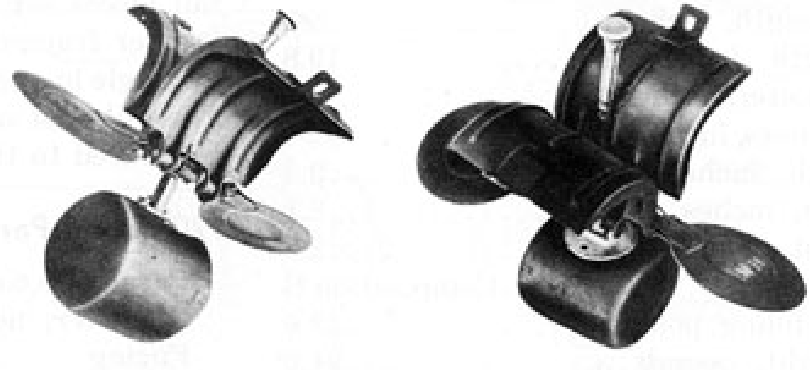


Figure 259. 2,000-pound S.A.P. Bomb M103

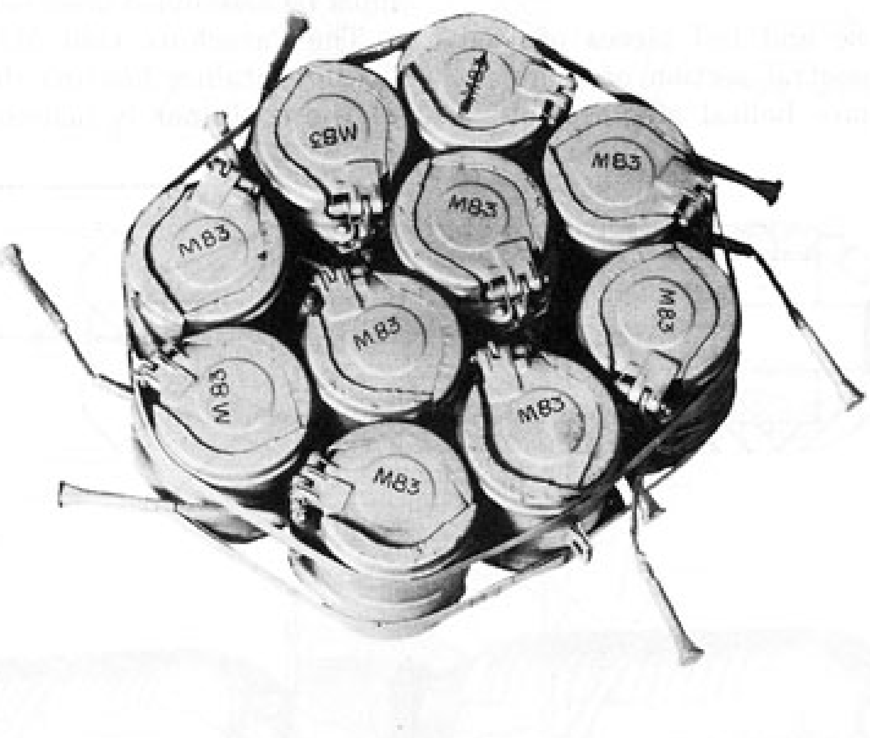
While the bomb is still in the cluster, the vane assembly is folded around the bomb to form a cylindrical casing which can be closed against the pressure of the vane coil springs by means of a safety clip. The arming spindle projects through the bomb casing.

When the bombs are packed in the cluster adapter, the safety clips are removed but the bombs remain in their closed status because of their proximity to each other. When the cluster adapter bursts open, the bombs scatter and the vane assembly on each bomb is spread open by

CLOSED



OPEN



WAFER CLUSTER

Figure 260. 4–pound Frag. "Butterfly" Bomb M83

the force of its coil springs. The vane assembly is forced by air resistance to the top of the arming spindle, where the square head on the spindle engages the square hole in the assembly. The two wings reduce the velocity of descent of the bomb. The two propellers, being set at angles to each other, cause the vane assembly to turn in a counterclockwise direction, thereby screwing the arming spindle out of the fuze body and permitting the fuze to arm. The arming spindle is not completely withdrawn from the fuze, being retained in the fuze by a collar on the spindle.

Markings: The bombs are painted olive drab, with a half-inch yellow band running horizontally around the folded wings.

90-pound Frag. M82

Over-all length, inches	28
Body length, inches	19.8
Body diameter, inches	6
Wall thickness, inch	0.94
Tail length, inches	9.3
Tail width, inches	8.1
Tail weight, pounds	2.8
Filling	Composition B
Weight of filling, pounds	12.0
Total weight, pounds	91.6
Charge/weight ratio	13.1%

Fuzing: M103, AN-M103, AN-M103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, M140, AN-M140A1, M149, M163, M164, M165, M166, T82.

Construction: Nose and tail pieces of cast steel screw onto a central section of seamless steel tubing. A square helical steel spring is wound around the steel tubing. The nose and tail pieces are partially cut through, to afford greater fragmentation. The bomb is suspended by single lug or in a cluster (M27) of six bombs. The tail is of normal U.S. box construction and is secured to the bomb by a locking ring.

120-pound Para.-Frag. M86

Parachute container length, inches	35.5
Diameter, inches	6.5
Fuzing	AN-M120 or AN-M120A1

Description: The M86 consists of the 90-pound Fragmentation Bomb M82, and a Parachute Unit M5 which is screwed to the base of the bomb body in place of the normal tail fin assembly. Both units are issued separately and must be assembled prior to use.

The Parachute Unit M5 consists of a cylindrical container housing the parachute. The lid of the container is fastened by a latch, which

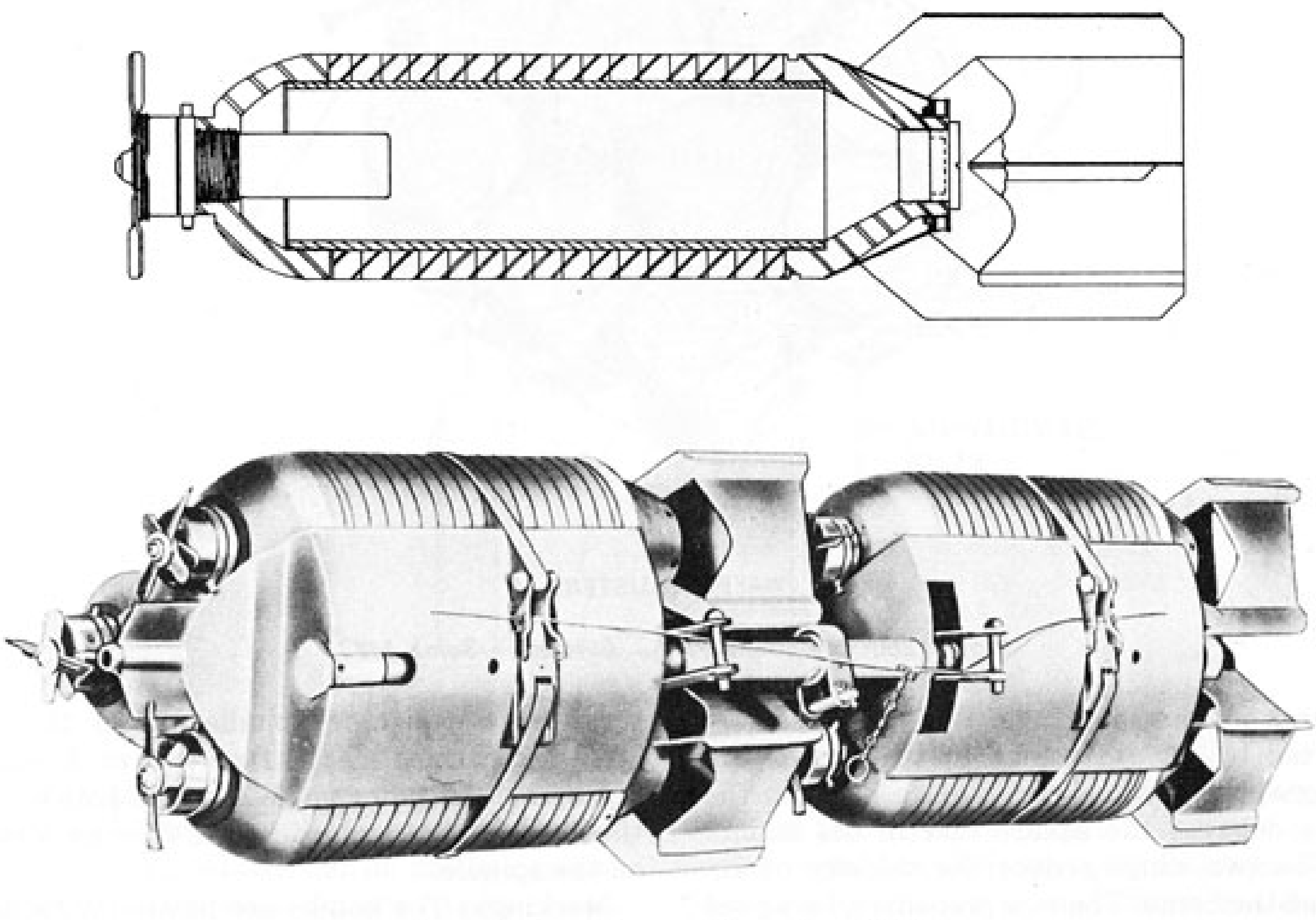


Figure 261. 90-pound Frag. Bomb M82

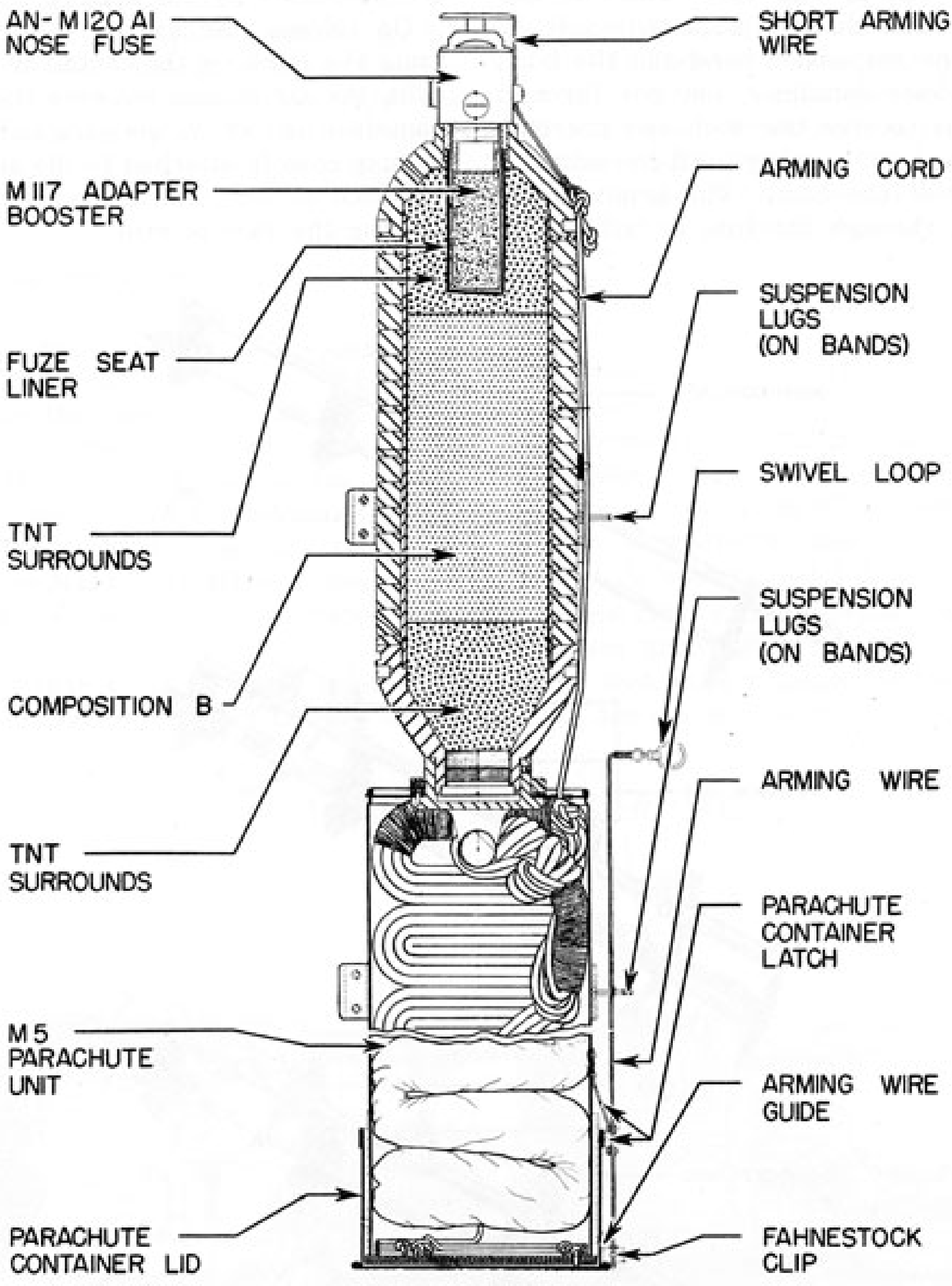


Figure 262. 120–pound Para.–Frag. Bomb M86

is secured by the arming wire.

The bomb is fuzed with the Fuze AN–M120 or AN–M120A1 by using the Adapter Booster M117.

Suspension: The bomb can be used in a bomb station having the clearance of a 500-pound bomb, and may be suspended singly or as a two-bomb cluster with the Cluster Adapter M12. One suspension lug is welded to the bomb at the center of gravity, and two suspension bands are issued with the parachute unit. The larger-diameter band is secured on the parachute unit to be used in conjunction with the suspension lug or the smaller-diameter band secured on the bomb body.

Operation: The arming wire, which is fastened to the bomb shackle, passes through the lug of the rear suspension band and the latch on the parachute container, but not through the fuze. This secures the latch and prevents the parachute from opening until immediately after release of the bomb. The arming wire which passes through the fuze is fastened to the parachute by the arming cord.

On release, the arming wire is withdrawn from the latch on the container. As the bomb falls, the air stream removes the lid from the container and allows the parachute to open. The arming cord is attached to the shroud line and is pulled as the parachute opens, thereby permitting the fuze to arm.

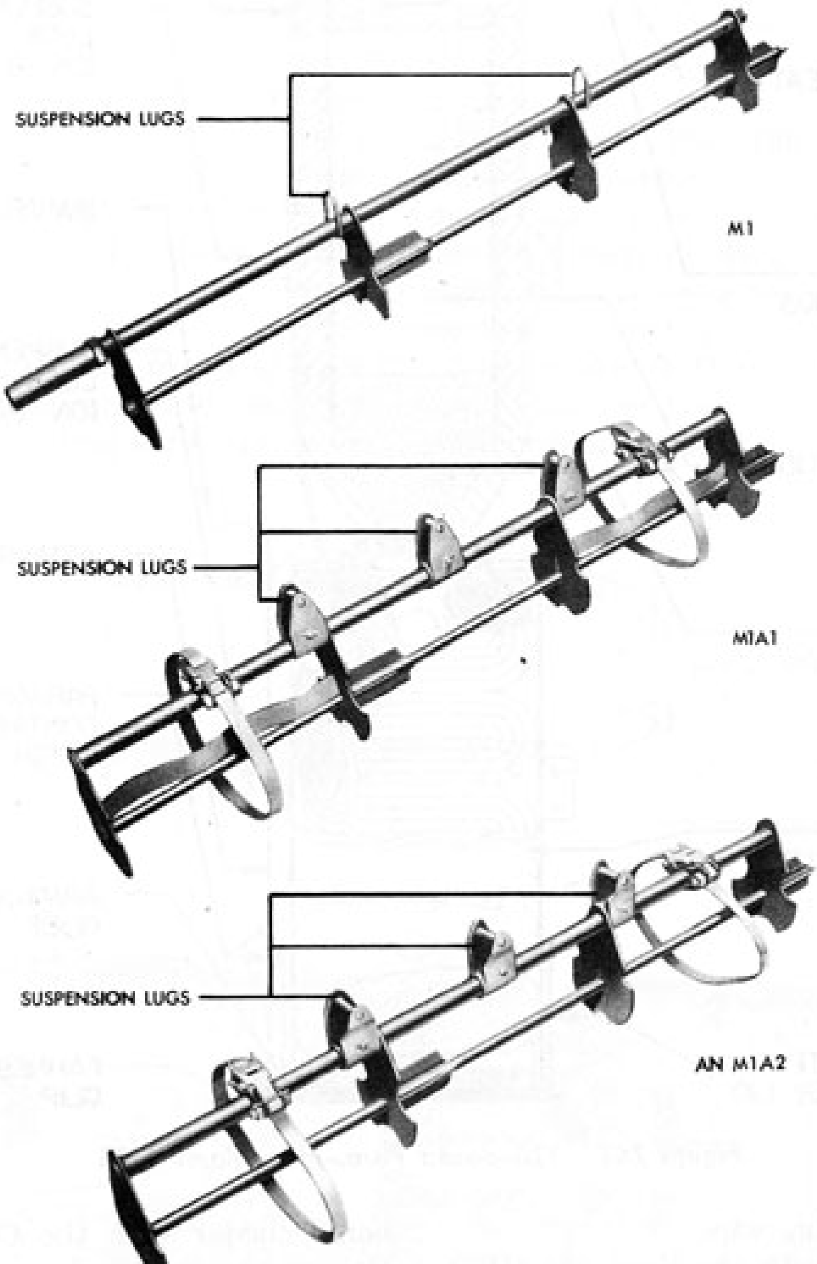


Figure 263. Cluster Adapters M1, M1A1, and M1A2

Fragmentation Bomb Clusters

M1—Adapter M1: 100-pound size for six 20-pound Frag. Bombs AN–M41. It is 46.75 inches long and weighs 125 pounds. It has lugs for double-hook suspension only. The release mechanism operates by means of a cartridge and firing mechanism.

M27—Adapter M14: 500-pound size cluster for six 90-pound Frag. Bombs M82. The adapter consists of two longitudinal steel tubes, 56 inches long, to which are welded four steel plates forming the support for the six bombs. The lower tube serves as the backbone of the cluster; and the upper tube carries the suspension lugs, the buckles for the releasing straps, and the adapters for the nose and tail fuzes. The Nose Fuze M111A2 or M155 is used; however, there is no mechanical time fuze in the tail.

The cluster may be adjusted to release the bombs immediately or, through the use of mechanical time fuzes, to discharge the bombs 5 to 92 seconds after the release of the cluster from the plane. If it is intended that the cluster is to open immediately, the shear wire is cut after the arming wire is installed, and no fuze is used. The immediate opening of the cluster produces the most favorable impact pattern. The cluster must open at a minimum altitude of 1,000 feet in order that the bomb fuze may arm.

M28—Adapter M15A1: 100-pound size for twenty-four 4-pound Frag. Bombs M83. It is a cylindrical sheet-metal case, which opens longitudinally, being hinged at the rear and closed by a nose cup. It is 47.35 inches long and 8 inches in diameter, and weighs 155 pounds loaded. It uses Fuze M155 or AN–M146.

These clusters are released from altitudes of not less than 3,000 feet and not more than 5,000 feet. Fuze settings for function after release are varied from five seconds at minimum

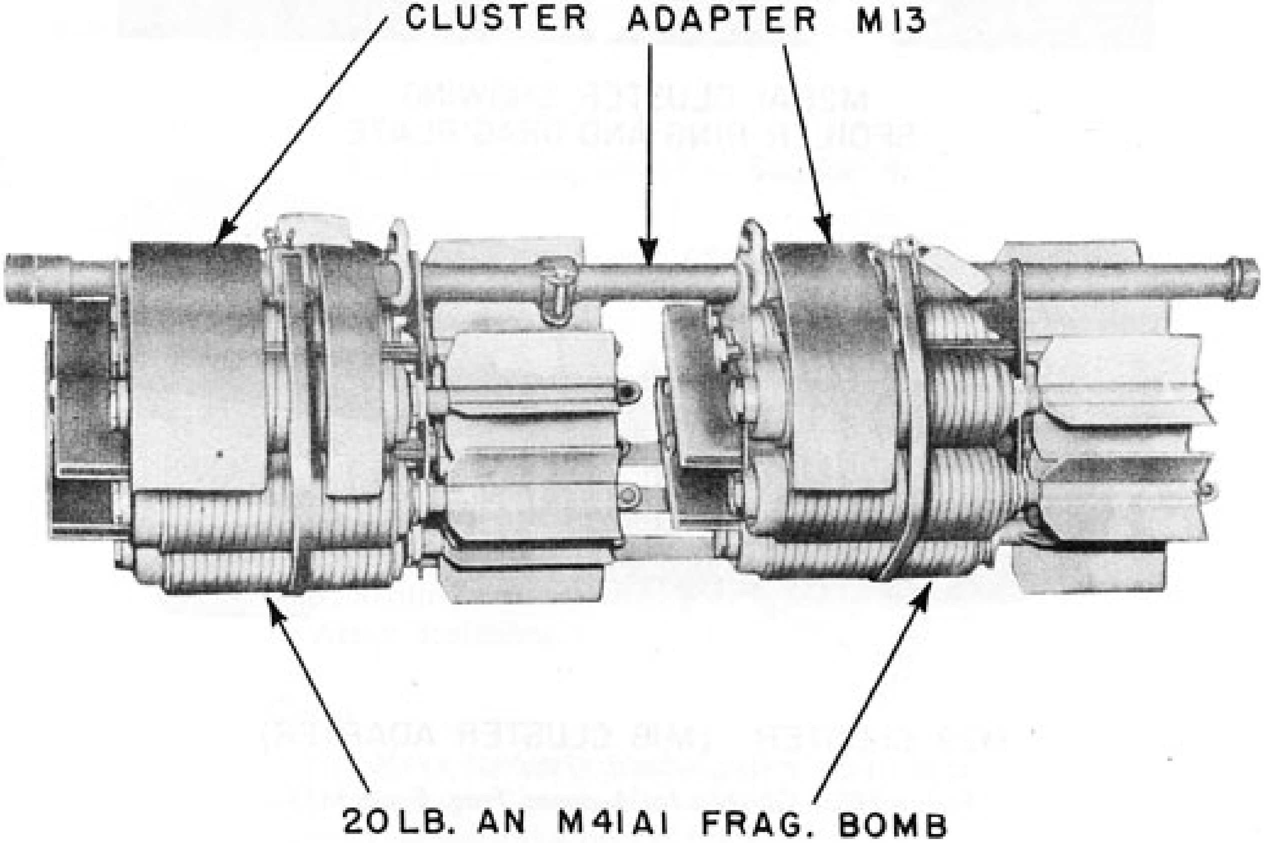
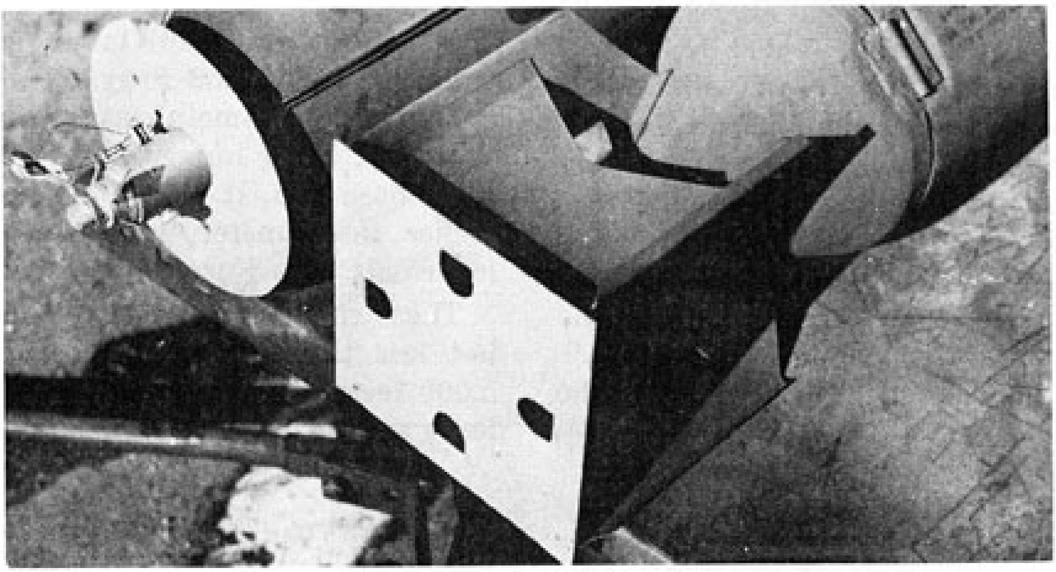
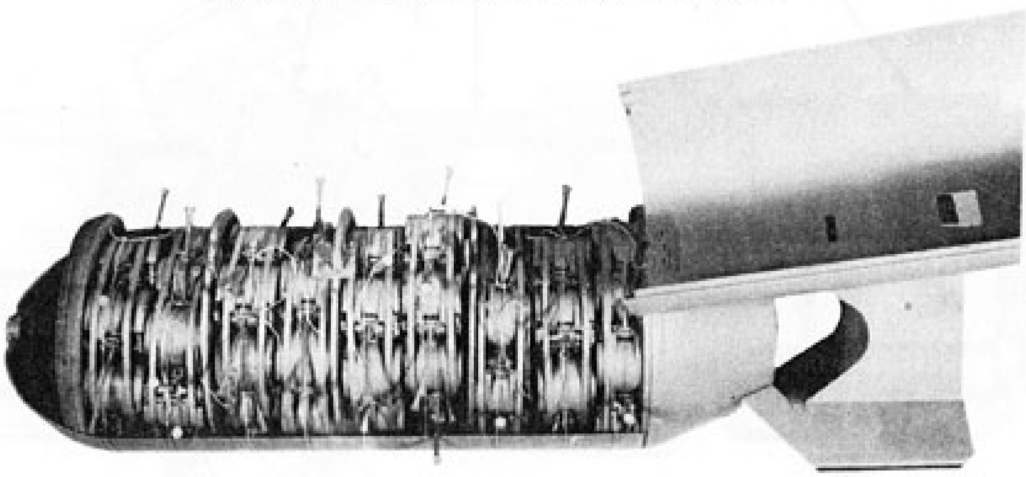


Figure 264. Typical Fragmentation Bomb Cluster (Cluster shown is M26. See page 409.)

M28 CLUSTER (M15 CLUSTER ADAPTER)



M28A1 CLUSTER, SHOWING
SPOILER RING AND DRAG PLATE



M29 CLUSTER (M16 CLUSTER ADAPTER)

Figure 265. Clusters for 4–pound Frag. Bomb M83

release altitude to eight seconds at maximum release altitude. When the fuze fires, it releases the nose closing cup, allowing the adapter to open and release the bombs. The bombs scatter to form a pattern over an area of approximately 300 by 200 feet.

M28A1—Adapter M15A1: The Cluster M28-A1 is the same as the M28, except that it incorporates a spoiler ring around the nose and a drag plate secured to the tail by four screws. These two devices were added because the dropping altitude for the M28 was limited by the high velocity attained by the clusters at high altitudes, resulting in damage to the butterfly when the cluster opened. When drag plates and spoiler rings are used, the recommended release altitude is 1,500 feet with a six-second fuze setting, or any higher altitude which will open the cluster at a height between 1,000 and 2,500 feet.

M28A2—Adapter M15A2: This A2 modification has a new locking cup, which is secured to the adapter by two slotted screws. Otherwise, it is the same.

M29—Adapter M16A1: 500-pound size for 90 4-pound Frag. Bombs M83. The container is like the M15, except for size. In the Adapter M16, the bombs are loaded in "wafer" assemblies. This cluster has a third single lug for British suspension.

M29A1—Adapter M16A2: This A1 modification has the new locking cap, secured to the adapter by two slotted screws. Otherwise, it is the same.

Remarks: For Navy usage, the Bureau of Ordnance recommends that the case-locking bushing it has developed be used with all "Butterfly" fragmentation clusters, including the M28, M28A1, M28A2, M29, and M29A1. One end of the bushing screws into the fuze adapter, and the other end is threaded internally to receive the fuze. The locking cup is retained positively by a safety wire which passes through a hole in the locking-cup tab and around a cotter pin placed in the bushing. When the fuze fires, the locking cup is blown into the cluster, shearing the loops of safety wire and allowing the adapter to open.

Part 6 — Chapter 17 — Section 4

NAVY "MK" SERIES

General

The Navy-designed bombs are generally similar to Army bombs of the same class. Since the formation of the Army-Navy Standard Board, early in 1941. the Navy has concentrated on designing bombs for naval targets and for carrier handling, leaving the other types of bombs to Army designers.

Color

The Navy formerly used a yellow paint over all; later, grey over all, with a yellow disc painted between the lugs if the bomb is a high-explosive type. Later productions may be found painted olive drab over all, with yellow bands.

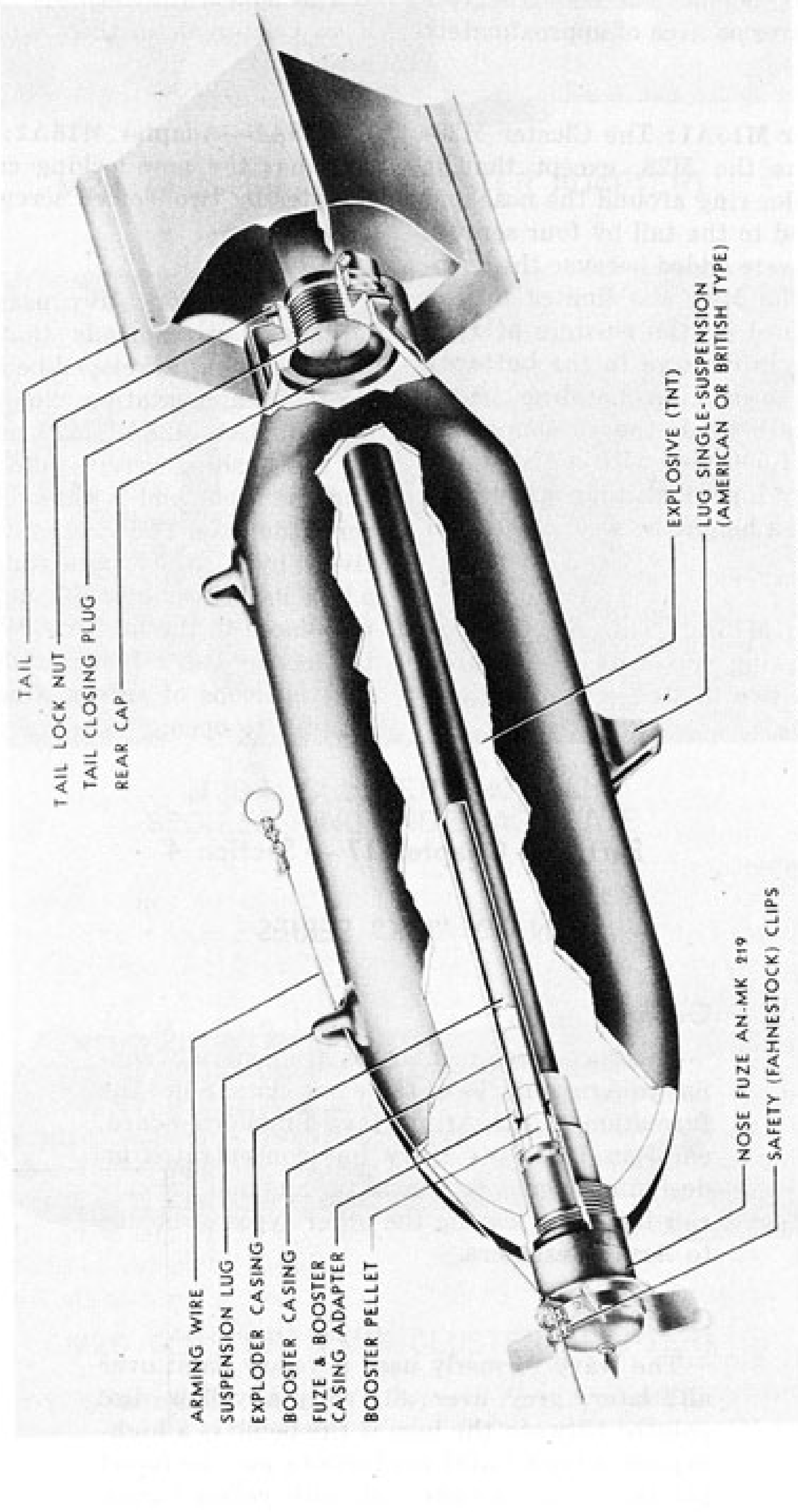


Figure 266. 100–pound G.P. Bomb Mk 4 Mod 4

100-pound G.P. Mk I Mods 2 and 3, Mk 4 Mods 1—4 (Obsolescent)

	Mk 1	Mk 4
Over-all length, inches	48.8	36.2
Body length, inches	—	28.0
Body diameter, inches	7.9	8.0
Wall thickness, inch	—	0.175
Tail length, inches	21.0	9.1
Tail width, inches	9.8	11.0
Filling	TNT	TNT
Weight of filling	65#	55#
Total weight	116#	120#, Mod 1 105#, Mod 4
Charge/weight ratio	56%	45.8%, Mod 1 52.8%, Mod 4

Fuzing: Nose Fuze AN–Mk 219, Nose Fuze Mk 233.

Body construction: Mk 1 has two sheet steel castings welded together, the bomb having a "tear drop" shape. Mk 4 is a single-piece steel forging; cylindrical, with ogival nose.

Suspension: Mk 1 is horizontally suspended by two lugs welded on the body; it may have single lug or trunnions on the band. Mk 4 has two lugs welded on the body 14 inches apart; with a single lug welded on the opposite side.

Color and markings: Grey over all with a four-inch yellow disc between the two lugs, indicating H.E. The color may be yellow over all.

Tail construction: Mk 1 has four vanes which pass down over the body and are welded to a tail cone. The vanes are fastened to the body of the bomb by screws and are braced by two sets of bar struts riveted to the vanes. Mk 4 has four vanes welded to a sleeve which is secured to the bomb body with a locking nut. Box-type internal struts are welded to the vanes.

500-pound G.P. Mk 3 Mod I, Mk 9, and Mk 12 Mods 0—2 (Obsolescent)

	Mk 12 Mod 2
Over-all length, inches	59.5
Body length, inches	42.6
Body diameter, inches	14.0
Wall thickness, inch	0.36
Tail length, inches	20
Tail width, inches	19.4
Filling	TNT
Weight of filling, pounds	256
Total weight, pounds	504
Charge/weight ratio	50%

Fuzing

NOSE—AN–Mk 219 (Instantaneous) Requires Mk 219 adapter ring and one additional Auxiliary Booster Mk 1. Mk 221 (0.01 second delay), Mk 243 Mod 0, Mk 244 Mods 0–1, Mk 239.

TAIL—Mk 223 (0.01 second delay), Mk 229, Mk 229 Mod 3.

Body construction: One-piece steel, forged or drawn; cylindrical with ogival nose.

Suspension: Horizontal suspension by two lugs or trunnions on band for dive bombing.

Color and markings: Grey over all with yellow disc between lugs, indicating H.E.

Tail construction: Four sheet metal vanes are welded to a cone which is attached to the body by a nut which surrounds the fuze. Box-type struts are used.

Remarks: The 500-pound G.P. Bomb Mk 12 Mod 2 is still to be found in the field, but is no longer being manufactured. The other Marks are obsolete. The Mk 12 and Mk 12 Mod 1 differ from the Mk 12 Mod 2 as follows: Trunnions are welded to the body. They also have two hoisting lugs welded to the body, a female base plate, and a right-angle fin sleeve instead of the conical type.

In order to get a wider selection of possible tail fuzings, use an Adapter Booster M102 with a 0.47-inch spacer ring, and install any of the following fuzes: AN–M101A2, M113A1 or M116.

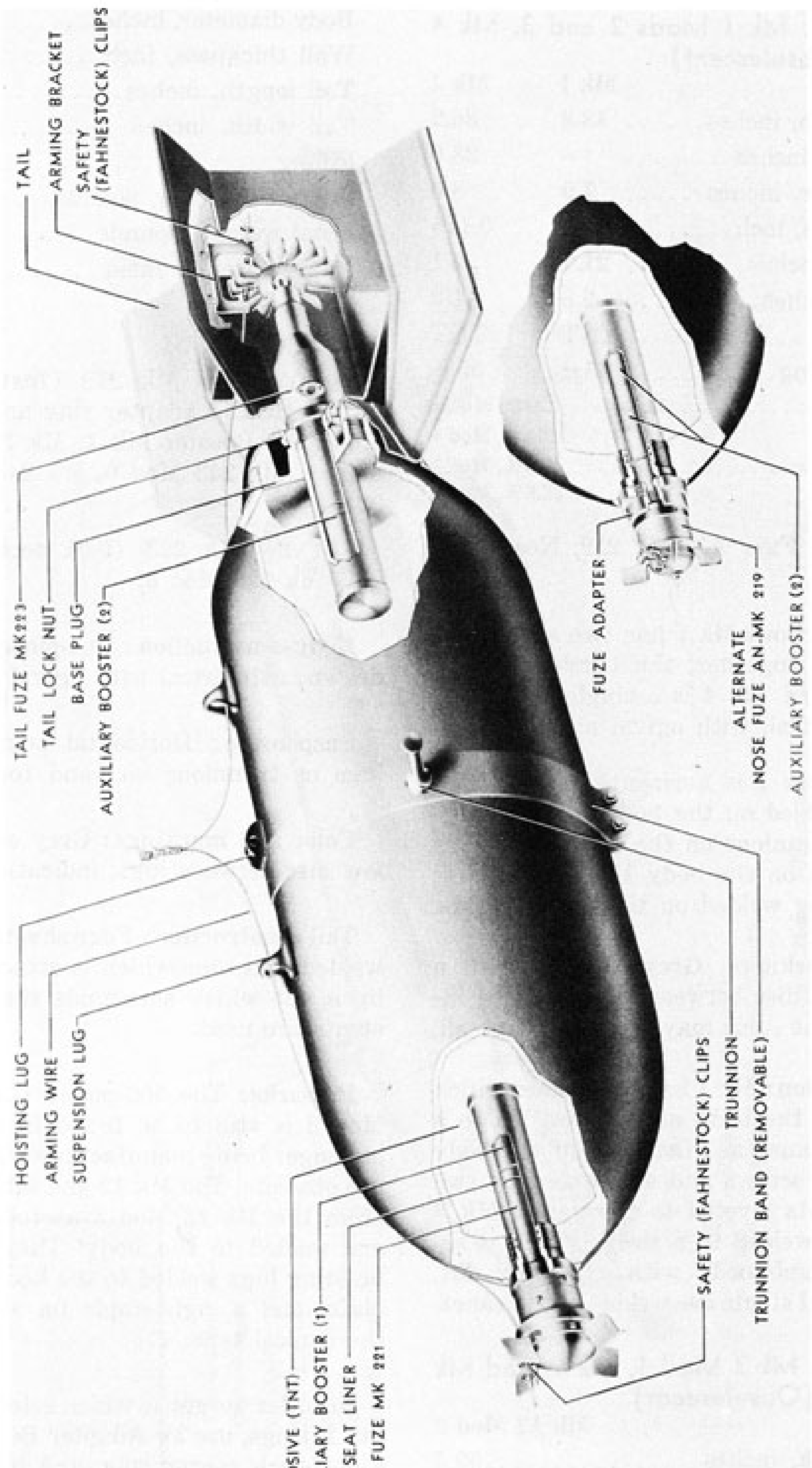


Figure 267. 500–pound G.P. Bomb Mk 12 Mod 2

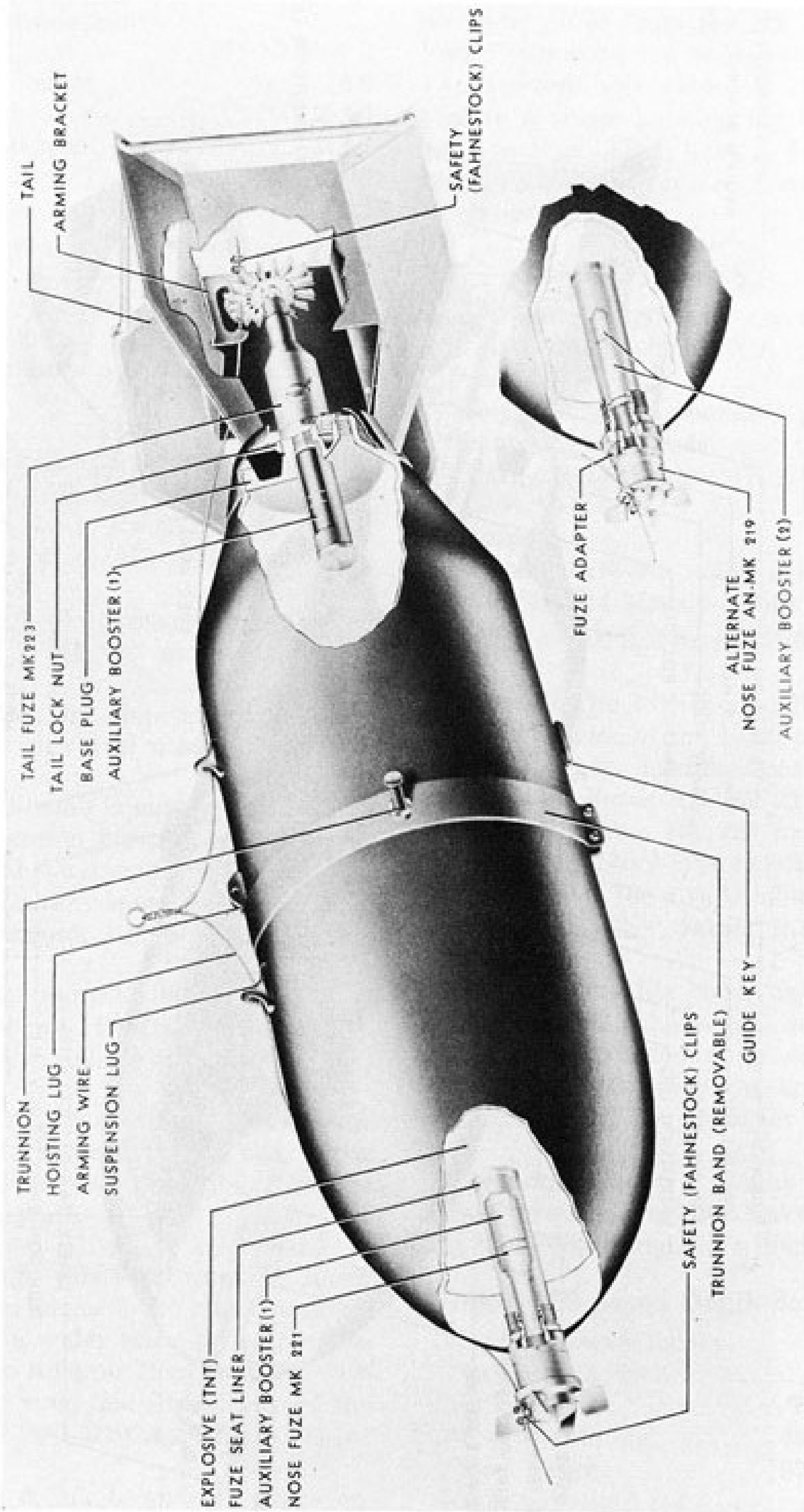


Figure 268. 1,000–pound G.P. Bomb Mk 13 Mod 2

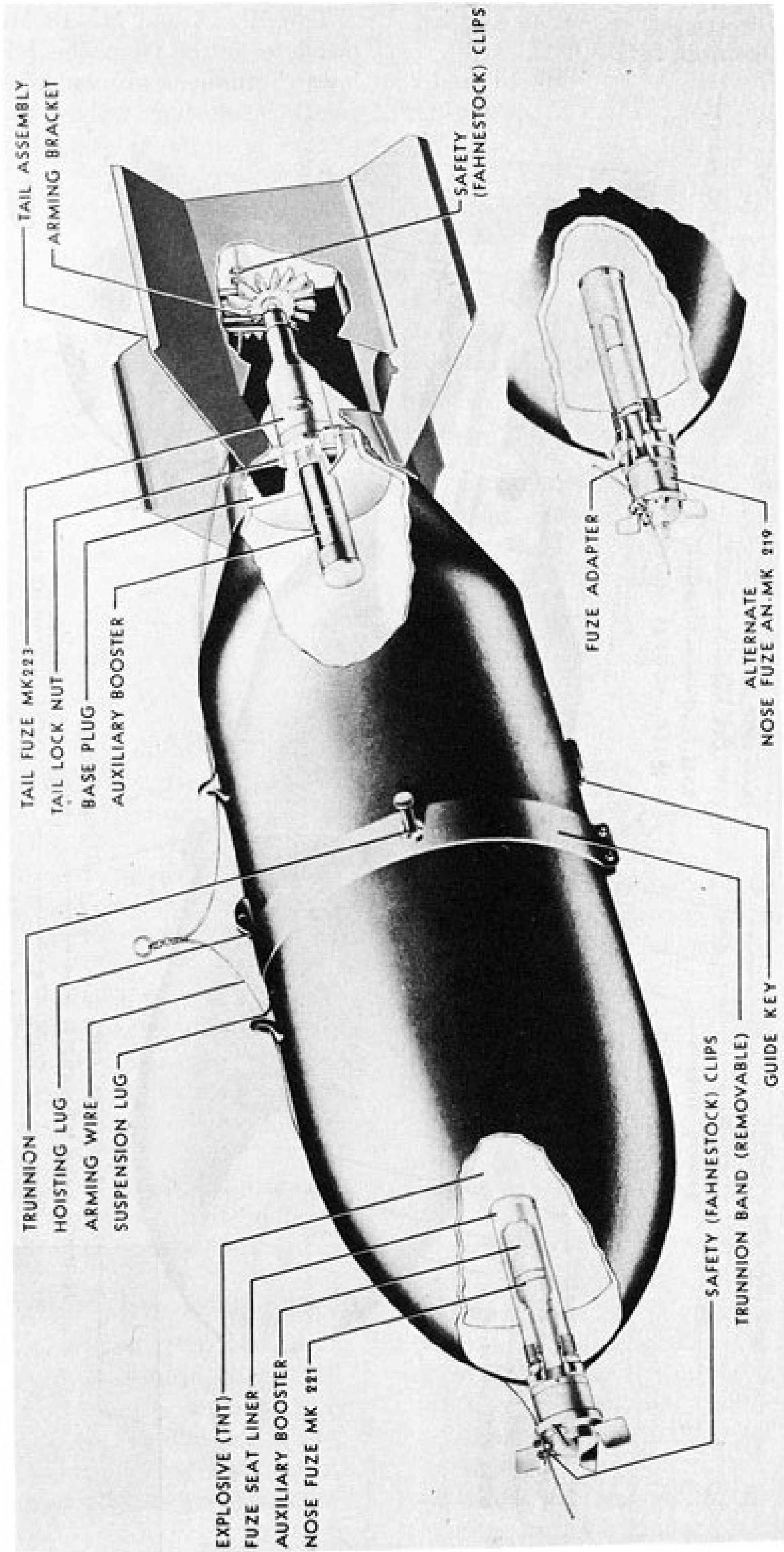


Figure 269. 1,000-pound G.P. Bomb Mk 36

1,000-pound G.P. Mk 3, Mk 5, Mk 9, and Mk 13 Mods 0—2 (Obsolescent)

	Mk 13 Mod 2
Over-all length, inches	72.6
Body length, inches	53.0
Body diameter, inches	17.7
Wall thickness, inch	0.45
Tail length, inches	22.3
Tail width, inches	23.5
Filling	TNT
Weight of filling, pounds	511
Total weight, pounds	1,005
Charge/weight ratio	51%

Fuzing

NOSE—AN–Mk 219 (Instantaneous). Requires Adapter Ring Mk 219 and one additional Auxiliary Booster Mk 1. Mk 221 (0.01 second delay), Mk 243 Mod 0, Mk 244 Mods 0–1, Mk 239.

TAIL—Mk 223 (0.01 second delay), Mk 229; Mk 229 Mod 3, Mk 230 and Mods.

Body construction: One-piece drawn or forged steel; cylindrical with ogival nose.

Suspension: The bomb is suspended horizontally by two suspension lugs, or by trunnions on the band around the body for dive bombing. A torpedo sling guide key is welded to the bomb for suspension in torpedo slings.

Color and markings: The bomb is painted grey over all, with an 11-inch yellow disc between the suspension lugs to indicate H.E.

Tail construction: Four vanes welded to the tail cone, which is secured to the body by a locking nut which screws onto the threaded collar of the base plate.

Remarks: Though this bomb may be found in the field, it is no longer being manufactured.

In order to get a wider selection of possible tail fuzings, use an Adapter Booster M102 with a 0.47-inch spacer ring, and install any of the following fuzes: AN–M102A2, M114A1, or M117.

The Bombs Mk 3, Mk 5, and Mk 9 are declared obsolete and will be expended in practice.

The Mk 13 and Mk 13 Mod 1, also declared obsolete, differ from the Mk 13 Mod 2 as follows: Trunnions are welded to body. There are two hoisting lugs welded to the body, in addition to a single hoisting lug between the suspension lugs. They have a female base plate and a right-angle fin sleeve instead of the conical type.

1,000-pound G.P. Mk 36

Over-all length, inches	71.2
Body diameter, inches	18.7
Filling	TNT
Weight of filling, pounds	558
Total weight, pounds	1,012
Charge/weight ratio	55%

Fuzing

NOSE—AN–Mk 219, Mk 221, Mk 243 Mod 0, Mk 244 Mods 0–1, Mk 239.

TAIL—Mk 223 or Mk 229 Mod 3.

General: The 1,000-pound Bomb Mk 36, is a modified version of the 1,000 pound G.P. Bomb, AN–M44. These modifications provide for the use of Nose Fuzes AN–Mk 219 or Mk 221, the use of Tail Fuzes Mk 223 or Hydrostatic Mk 229 Mod 3, a Navy-type hoisting lug and guide key, trunnions for dive bombing, and an explosive filling of TNT, rather than 50-50 Amatol.

Description: This bomb has two suspension lugs, spaced 14 inches apart, welded to the bomb body for suspension from double-hook racks and shackles. A guide key is provided on the opposite side of the bomb for sling suspension.

Remarks: The G.P. Bomb Mk 36 was designed primarily by the Navy as an alternate for the 1,000-pound G.P. Bomb Mk 13 Mod 2.

7.0-inch 100-pound Depth Bomb Mk 52

Over-all length, inches	45.9	
Body length, inches	7.0	
Filling	TNT	or Torpex
Weight of filling	45.3#	50.3#
Total weight	99.1#	104.1#
Charge/weight ratio	46%	49%
Fuzing	Mk 140	

General: This is a light-case, fast sinking, round-nose bomb for use by airships. It is carried in a Bomb Rack Mk 53 and, accordingly, has no trunnions, trunnion bands, or suspension lugs. A cylindrical shroud is fastened to the tail section by four vanes. The entire tail assembly is fastened to the rear of the bomb body by six flat-head machine screws. A cast-iron nose, into which is fitted a booster can, is secured to the bomb body. The bomb is filled with either TNT or Torpex. The Nose Fuze Mk 140 will normally function on impact with a solid object below the surface of the water, but will also function upon striking the surface of the water at any velocity greater than approximately 300 feet per second. This velocity may be attained in a free fall from a vertical height of 1,400 feet.

650-pound Depth Mk 29 (Obsolete) and Mk 37 (Obsolete)

	Mk 29	Mk 37
Over-all length, inches	70.0	63.0
Body length, inches	41.0	41.0
Body diameter, inches	17.7	17.7
Wall thickness, inches	0.12	0.12
Tail length, inches	36	29
Tail width, inches	17.7	17.7
Filling	TNT	TNT
Weight of filling	464#	464#
Total weight	657#	659#
Charge/weight ratio	70%	70%

Fuzing

NOSE—AN–M103 (Instantaneous); AN–M103A1; AN–Mk 219 (Instantaneous); Mk 221; Mk 239.

ATHWARTSHIP—AN–Mk 224 or AN–Mk 234.

TAIL—Mk 229, Mk 229 Mod 3; AN–Mk 230, Mods.

Body construction: These bombs are manufactured with a hemispherical nose reinforced with a steel disc. The suspension lugs are reinforced with a steel strip. A flat-nose attachment, in the shape of a bucket and fitting down under the nose of the bomb, can be used to improve underwater trajectory. The vacant spaces are then filled with plaster of paris. These attachments increase the weight by 72 pounds.

Suspension: Horizontal suspension is provided by the usual two suspension lugs, with threaded holes on each side 90° removed to receive trunnion lugs for the displacement gear of dive bombers.

Color and markings: The bombs are painted olive drab or grey over all, with an 11-inch yellow disc between the two suspension lugs. They may be light grey over all.

Tail construction: Four sheet-steel vanes are welded to the tail cone, which is secured to the body by a locking nut screwing onto the rear of the body. An annular strut is used around the rear of the vanes. The tail of the Mk 37 was shortened by seven inches so that the Tail Fuze Mk 229 could arm more readily. Otherwise, the tail is similar to that of the Mk 29.

Remarks: AN–Mk 219 will not arm under 2,500 feet of altitude if the flat-nose attachment is used.

Use Adapter Ring Mk 219 and insert an additional auxiliary booster when using AN–Mk 219.

AN–M103 or AN–M103A1 will not arm with the flat-nose attachment, unless special arming vanes are used.

An extender is supplied with each bomb to permit installation of the Hydrostatic Fuze AN–Mk 224 or AN–Mk 234 in the longer athwartships tube.

The Mk 29 is converted to the Mk 37 by replacing the tail.

Because of numerous instances in water crash landings where depth bombs fuzed with the Athwartship Fuze AN–Mk 224 or AN–Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the Depth Bombs Mk 29 and Mk 37 may be used only if a nose impact fuze is installed.

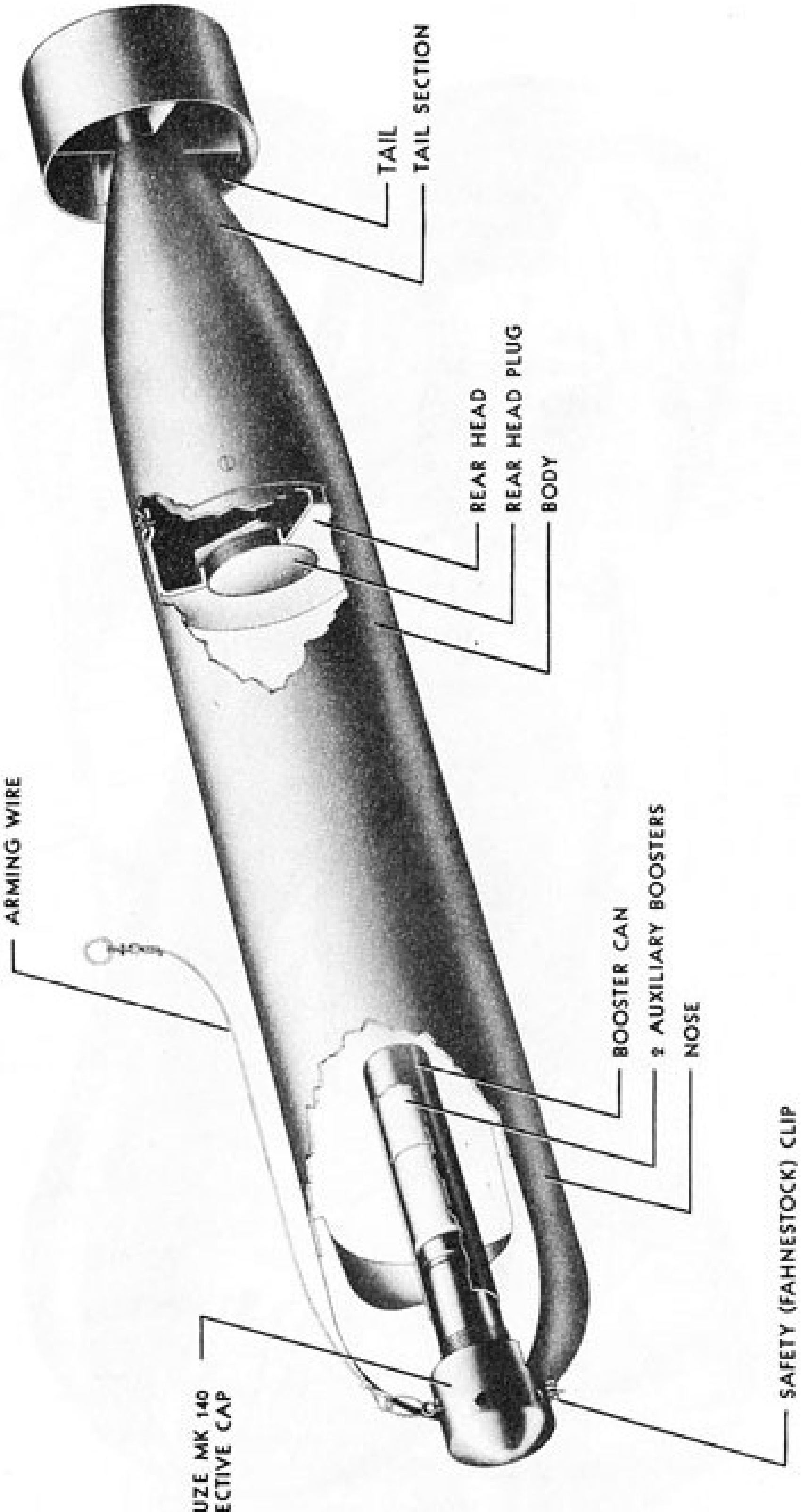


Figure 270. 7.0-inch 100-pound Depth Bomb Mk 52

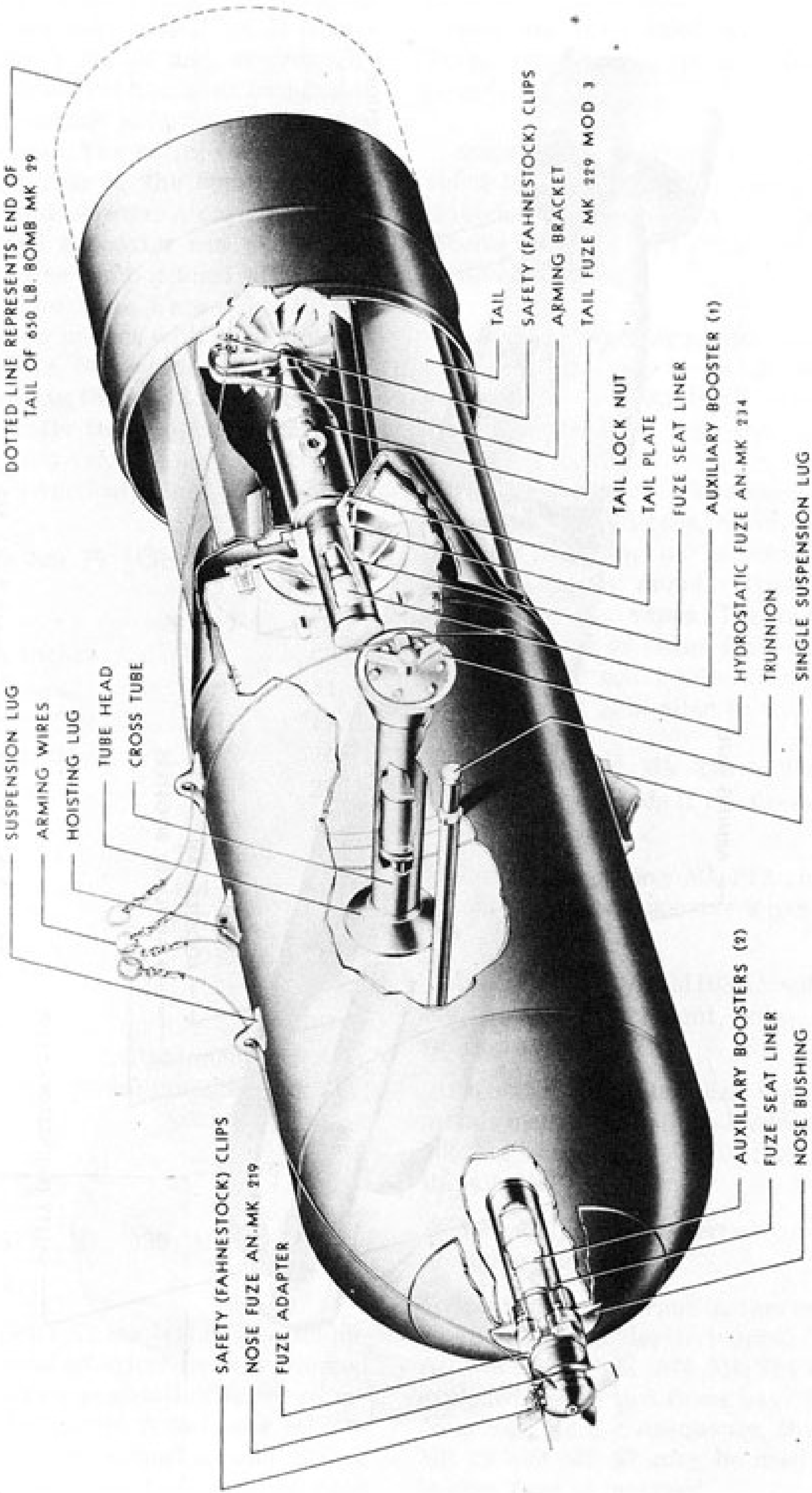
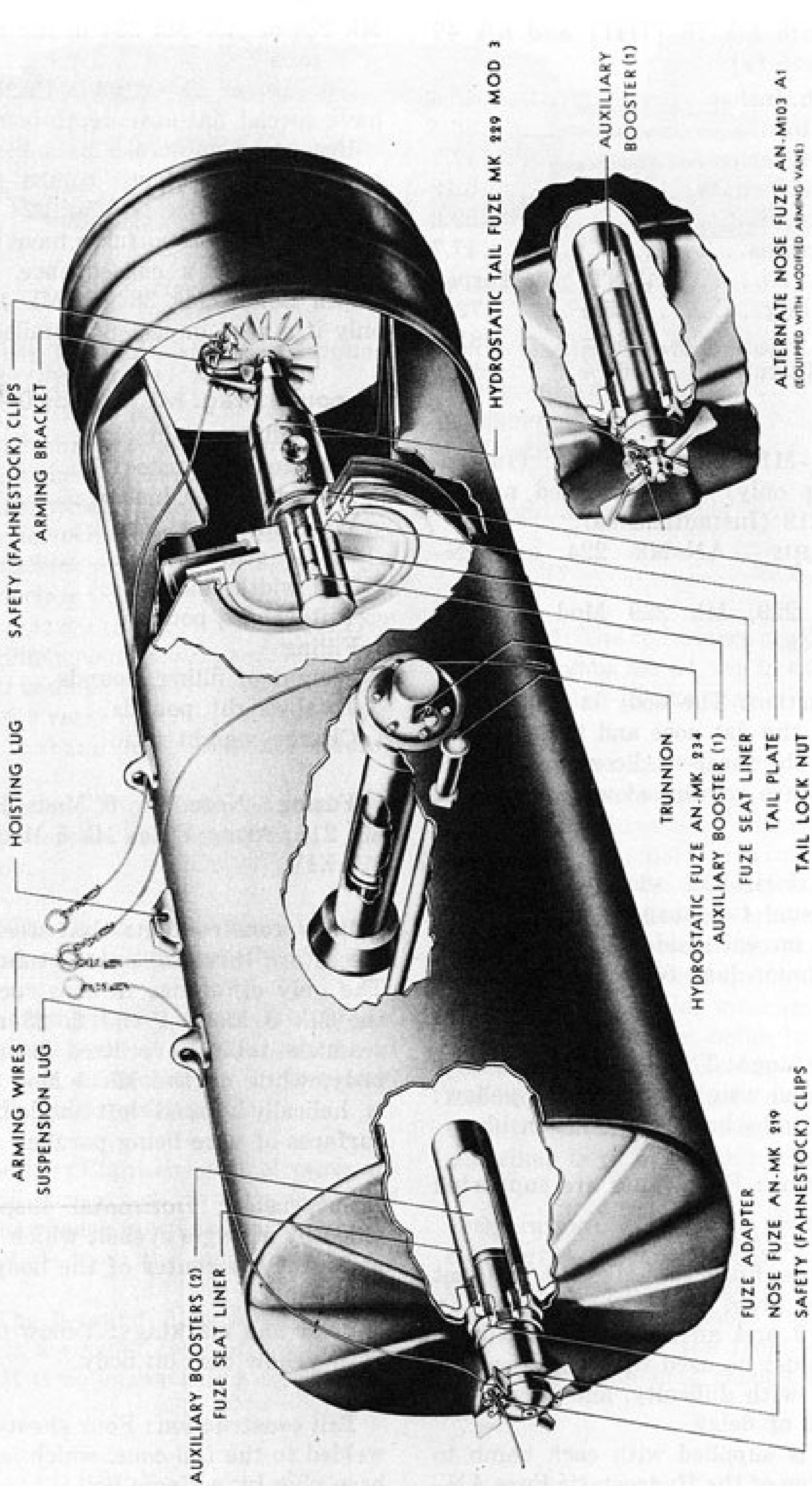


Figure 271. 650–pound Depth Bombs Mk 29 and Mk 37


HYDROSTATIC TAIL FUZE MK 229 MOD 3
AUXILIARY BOOSTER (1)
ALTERNATE NOSE FUZE AN-M103 A1
(EQUIPPED WITH MODIFIED ARMING VANE)
SAFETY (FAHNESTOCK) CLIPS
ARMING BRACKET
HOISTING LUG
TRUNNION
HYDROSTATIC FUZE AN-MK 234
AUXILIARY BOOSTER (1)
FUZE SEAT LINER
TAIL PLATE
TAIL LOCK NUT
ARMING WIRES
SUSPENSION LUG
AUXILIARY BOOSTERS (2)
FUZE SEAT LINER
FUZE ADAPTER
NOSE FUZE AN-MK 219
SAFETY (FAHNESTOCK) CLIPS

650-pound Depth Mk 38 (TNT) and Mk 49 (Torpex) (Obsolete)

Overall length, inches	58.5	
Body length, inches	36.4	
Body diameter, inches	17.7	
Wall thickness, inch	0.12	
Tail length, inches	29.0	
Tail width, inches	17.7	
Filling	TNT	Torpex
Weight of filling	425#	472#
Total weight	634#	681#
Charge/weight ratio	67%	69%

Fuzing

NOSE—AN–M103; AN–M103A1 (Instantaneous setting only) with modified arming vane. AN–Mk 219 (Instantaneous).

ATHWARTSHIP — AN–Mk 224 or AN–Mk 234.

TAIL—Mk 229, Mk 229 Mod 3; AN–Mk 230 and Mods.

Body construction: The body is constructed in three pieces, the flat nose and tail piece being welded onto the sheet-steel center tube. The suspension lugs are reinforced with a strip of sheet steel.

Suspension: Horizontal suspension is provided by the usual two suspension lugs, with threaded holes on each side 90° removed to receive the trunnion lugs for suspension from dive bombers.

Color and markings: TNT-loaded bombs have Mark numbers and weight stencilled in yellow; Torpex-loaded bombs have markings in blue.

Tail construction: Four vanes are supported by a circular strut.

Remarks: Nose Fuze AN–Mk 219 will not arm if dropped from under 2,500 feet. An Adapter Mk 219 and an additional Auxiliary Booster Mk 1 must be used with this fuze.

Mk 221 arms with difficulty, and should not be used because of delay.

An extender is supplied with each bomb to permit installation of the Hydrostatic Fuze AN–Mk 224 or AN–Mk 234 in the longer athwartship tube.

Nose Fuzes AN–M103 and AN–M103A1 must have special flat-nose depth-bomb vane.

Because of numerous instances in water crash landings where depth bombs fuzed with the Athwartship Fuze AN–Mk 224 or AN–Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the 650-pound Depth Bombs Mk 38 and Mk 49 may be used only if a nose impact is installed.

30-pound Frag. Mk 5 Mods 0—3 (Obsolete)

Over-all length, inches	22.2
Body length, inches	12.8
Body diameter, inches	4.2
Wall thickness, inch	0.57
Tail length, inches	7.0
Tail width, inches	6.5
Tail weight, pounds	2.5
Filling	Cast TNT
Weight of filling, pounds	4.5
Total weight, pounds	33.4
Charge/weight ratio	13.0%

Fuzing: Nose Mk 5 Mods 2 and 3; AN–Mk 219; Army Fuzes Mk 5 Mods 0 and 1; and Mk XIV.

Body construction: Cast-steel nose and tail pieces are threaded onto a tubular steel body. The only difference in construction is that in the Mk 5 Mods 1 and 2, 23 rings cut from seamless tubing are fitted around the tubular body, while on the Mk 5 Mod 3, a steel wire is helically wound left-handed, the adjacent surfaces of wire being parallel.

Suspension: Horizontal suspension is provided by a single eyebolt which is screwed into a ring at the center of the body.

Color and markings: Yellow over all or grey with yellow disc on body.

Tail construction: Four sheet-steel vanes are welded to the tail cone, which is secured to the base plug by a single bolt.

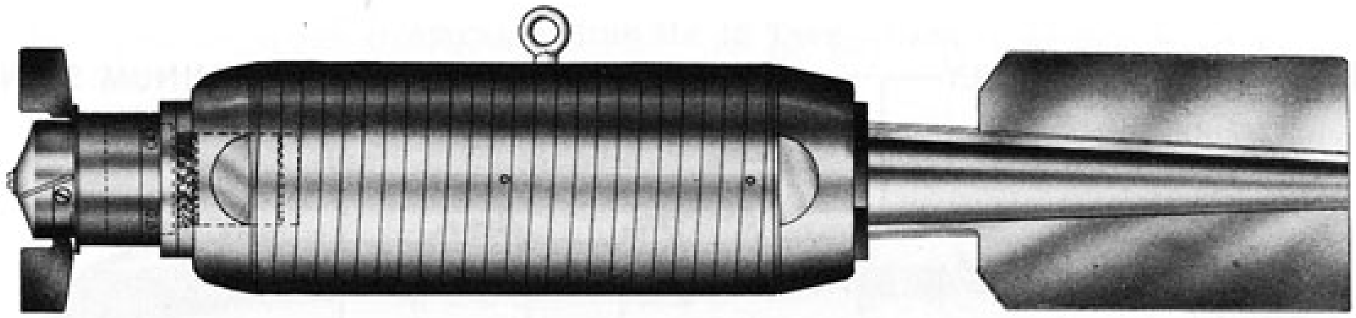


Figure 273. 30–pound Frag. Bomb Mk 5 Mod 3

5-pound A.A. Mk 34 (Obsolete) and 3-pound Type C Mk 32 (Obsolete)

	Mk 34
Over-all length, inches	15.0
Body length, inches	12.0
Body diameter, inches	3.0
Wall thickness, inch	0.05
Tail length, inches	3.0
Tail width, inches	3.0
Filling	TNT
Weight of filling, pounds	1.9
Total weight, pounds	5.5
Charge/weight ratio	34.5%
Fuzing	Mk 227 (Nose)

Body construction: The reinforced steel nose and conical tail section are welded to a cylindrical steel body.

Suspension: The Container Mk 3 or Mk 3 Mod 1 is used. Its capacity is 20 Bombs Mk 34.

Color and markings: The bombs are painted grey or olive-drab over all. If grey, they will have a yellow disc on the body; if olive-drab, they will have a yellow nose band.

Tail construction: Eight sheet-steel vanes are welded to a tail cone which, in turn, is welded to the body. The vanes are welded on the cone at a ten-degree angle from the longitudinal axis.

Remarks: The 3-pound A.A. Bomb Type C (Mk XXXII) is a smaller copy of the 5-pound Bomb Mk 34. It is no longer being used.

Bomb Container Mk 3 Mod 1

Over-all length, inches	51.1
Diameter, inches	13.2
Weight unloaded, pounds	Mk 3 — 65
	Mk 3-1— 67
Weight loaded, pounds	Mk 3 —175
	Mk 3-1—177
Capacity	20 A.A. Bombs Mk 34

General: The containers are designed to carry 20 A.A. Bombs Mk 34, ten in the front compartment and ten in the rear.

Description: Each housing assembly contains three bomb bays running lengthwise, the outside holding three bombs in each, and the center holding four bombs; a total of ten for each assembly. The bombs are loaded onto three ejector springs that run crosswise of the housing and are anchored on the flange on each side of the housing. These springs eject the bombs after the door-opening mechanism unlatches the doors. After the last bomb has left each compartment, the door-closing mechanism shuts and holds the doors closed under spring tension until the container is re-loaded. The skin of the container is of sheet aluminum.

Operation: When the operating switch is closed, the Solenoid Mk 24 or Mk 24 Mod 1, mounted on each of the door-opening assemblies, is energized. The solenoid unlatches the doors. The ten bombs in the front compartment are expelled on the first closing of the operating

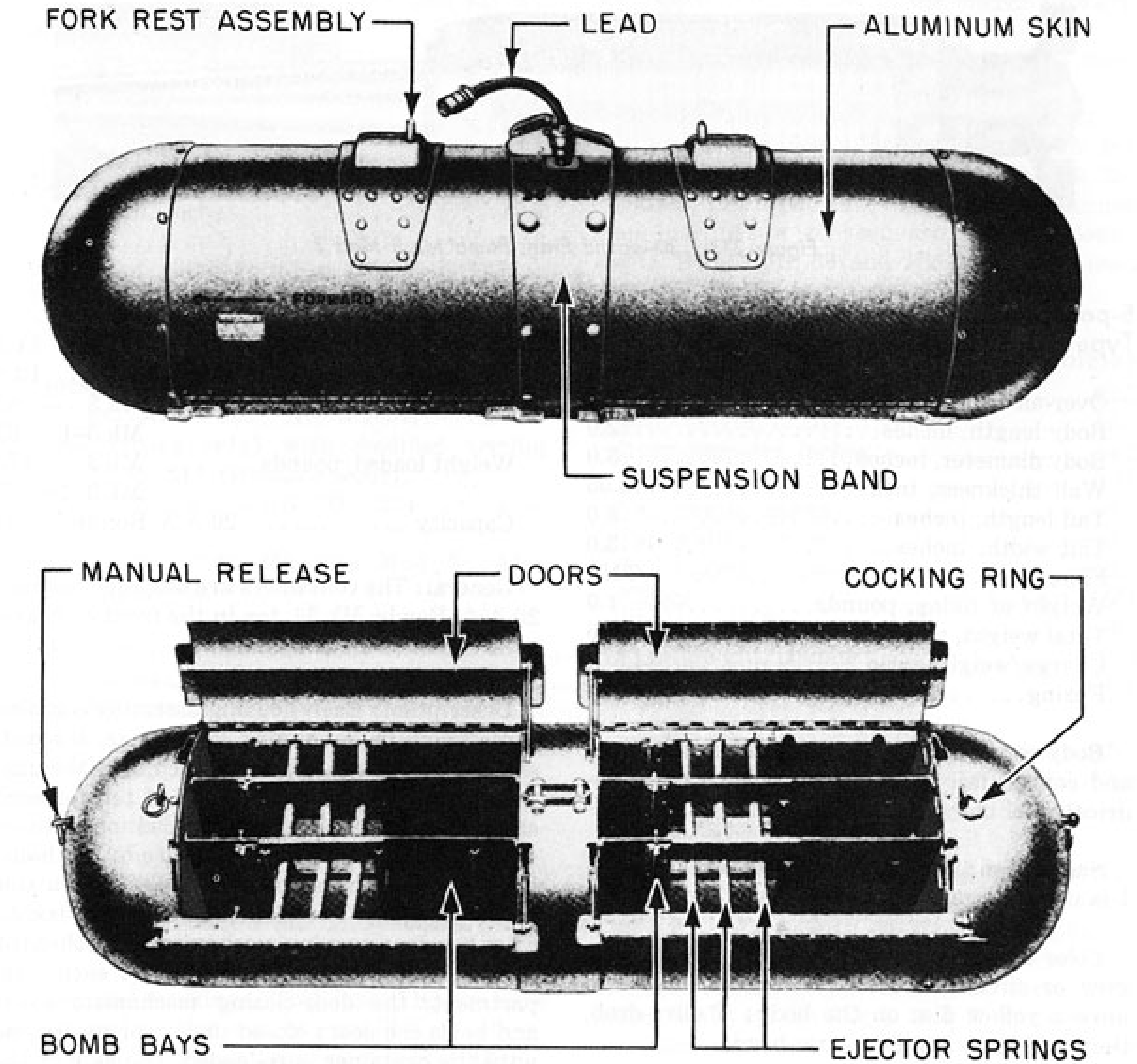


Figure 274. Bomb Container Mk 3 Mod 1

switch, and the ten in the rear are expelled on the second closing of the switch. The container can also be operated manually.

Remarks: The Bomb Containers Mk 3 and Mk 3 Mod 1 are identical, with exception of the suspension band, fork rests, and outside skin.

AIRCRAFT MINE MK 13 TYPE—DATA

Over-all length, inches	68.75			
Diameter, inches				
Case	19.875			
Tail section	15.25			
Fins on tail section	25.50			
	Mods 0, 3, 4		**Mod 5**	
Explosive filling	TNT	Torpex	TNT	Torpex
Weight of filling, pounds	640	700	640	700
Total weight, pounds	1,030	1,090	1,000	1,060
Charge/weight ratio	62.0%	63.3%	64.0%	66.0%
Negative buoyancy, pounds	430	490	—	—
Fuzing for use as mine	Athwartship			
Mine mechanisms				
Forward well	Extender and booster			
After well	Clock starter and clock delay			
Fuzing for use as bomb	Nose fuzes AN–M103, AN–M103A1, M135, M135A1, M136, M136A1, M139, F139A1, AN–M139A1, M140, M140A1, AN–M140A1, M149, M163, M164, M165, AN–Mk 219 (by using adapter ring and one Auxiliary Booster Mk 1)			

1,000-pound Aircraft Mine Mk 13 Mod 0, Magnetic Induction; Mk 13 Mod 3, Magnetic Induction; Mk 13 Mod 4, Magnetic Induction; and Mk 13 Mod 5, Acoustic

General: The Aircraft Mine Mk 13 Type is designed as a ground influence mine, laid offensively by aircraft from altitudes of 100 to 500 feet in 16 to 75 feet of water (40-100 feet for Mk 13 Mod 5) against surface craft and up to 500 feet against submarines. The Aircraft Mines Mk 13 Mods 0, 3, and 4 are magnetic induction mines using the Search Coil Firing Mechanism M4, while the Mk 13 Mod 5 is an acoustic mine utilizing the Acoustic Firing Mechanism A3.

When the mine is dropped as a bomb, the minimum altitude of release is 1,200 feet to insure pilot safety. Because of the shape of the mine, the standard bomb nose fuzes require longer air travel to arm.

Mine construction: The body is a cylindrical steel case with a welded hemispherical nose containing a fuze seat liner which houses an adapter ring and two Auxiliary Boosters Mk 1. The cylindrical tail section is of a smaller diameter and is welded to the body. The dome steel tail cover of the Mk 13 Mod 5 is modified to contain the Microphone MI–2; the rubber diaphragm microphone cover of the Mk 13 Mod 5 is stamped with the word "BRUSH." Horizontal suspension is accomplished by either of three sets of lugs placed 45° apart; each set consists of two standard lugs 14 inches apart.

Color: Black over all.

Remarks: The extender and clock starter are activated by hydrostatic pressure at a depth of 16 feet or greater. The clock delay runs off in 45 minutes to arm the mine.

The Aircraft Mine Mk 13 Mod 3 is a Mk 13 Mod 0 fitted with the Tail Parachute Pack Mk 1.

In the Mk 13 Mod 4, the extender and clock starter are modified for shallow-water planting, allowing the mine to function in ten feet of water. In other respects the Mk 13 Mod 4 is identical to the Mk 13 Mod 0.

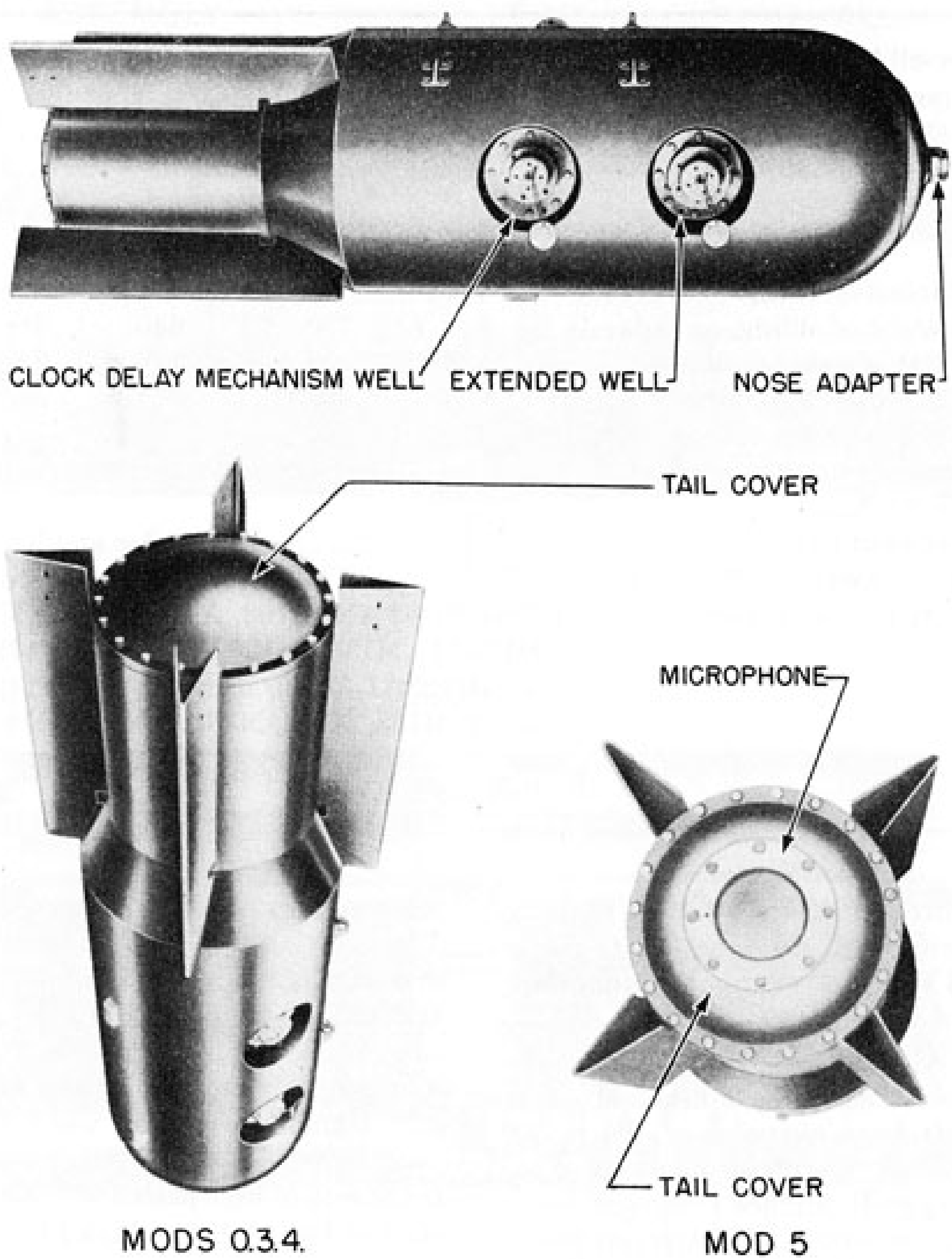


Figure 275. 1,000–pound Aircraft Mine Mk 13

Cluster Adapter Mk 3 Mod 0

General: The Cluster Adapter Mk 3 Mod 0 is used to cluster three bombs for external suspension on V.B.F.-type aircraft. The purpose of this cluster is to increase the bomb-load capacity of fighter planes. Five types of bombs may be used with this adapter, as outlined below:

Bombs	Weight of Cluster (pounds)
3—100-pound G.P. AN–M30A1	364
3—90-pound Frag. M82	300
3—220-pound Frag. AN–M88	688
3—260-pound Frag. M81	800
3—100-pound Incend. AN–M47A2	340

The adapter consists of a band incorporating a take-up bolt, a frame assembly, and a delay opening pistol assembly.

Operation: When the cluster is dropped, the arming wires are withdrawn and the pistol and tail fuze vanes are free to rotate. After approximately 45 revolutions of the vanes, the arming screw will thread far enough out to allow the firing-pin release levers to cam in. The firing-pin spring, acting through the firing pin on the firing-pin release levers, will cause the upper portion of the firing-pin release levers to cam in. The lower portion of the firing-pin re-

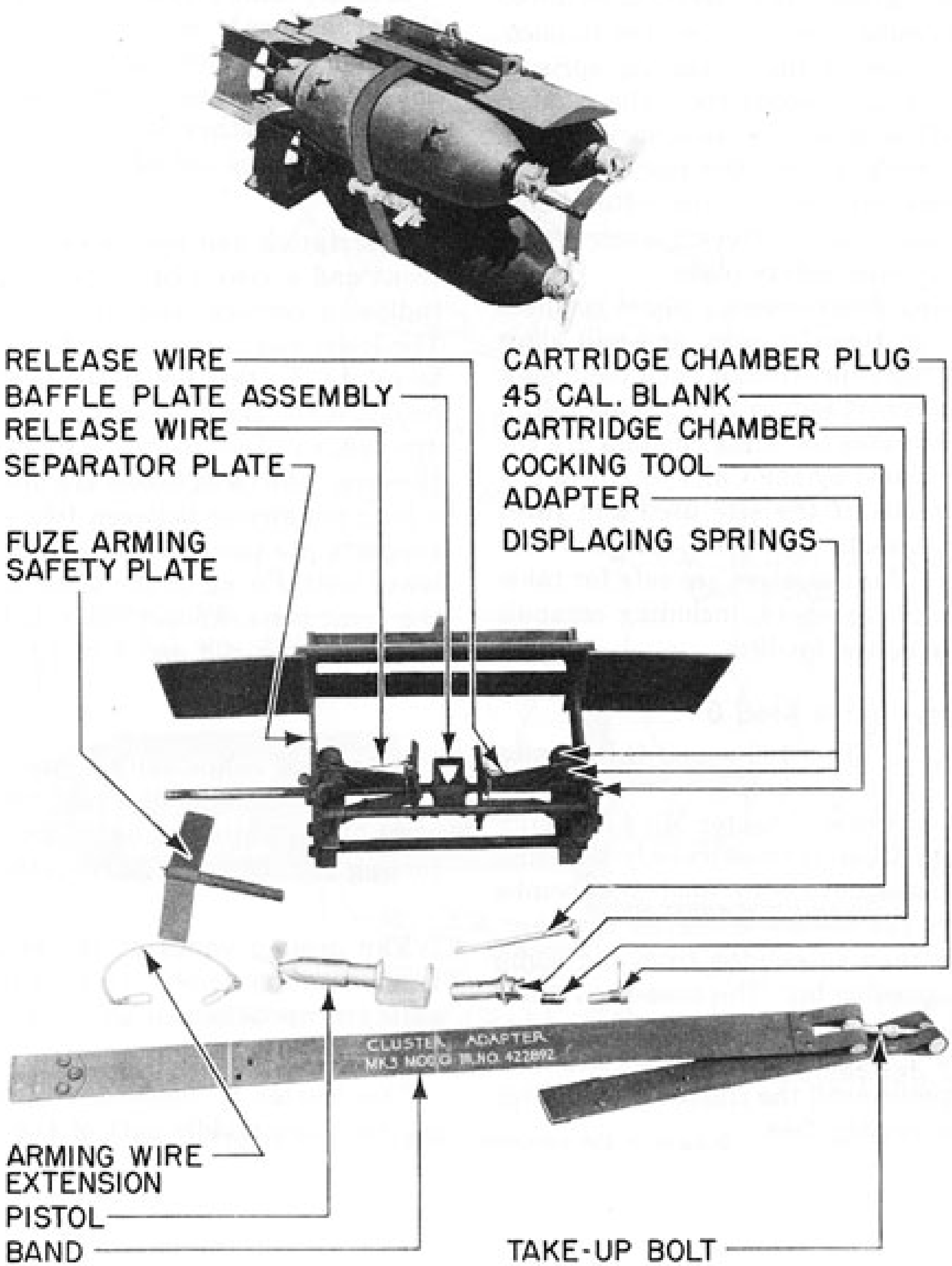


Figure 276. Cluster Adapter Mk 3 Mod 0

lease levers then releases the firing pin, allowing it to move aft under action of the firing-pin spring, to strike the percussion cap of the caliber .45 blank cartridge.

Explosion of the blank cartridge expels the cartridge chamber and cartridge-chamber plug (as a unit) from the pistol cradle, pulling the two cotter pins out as they are ejected. The cluster band clamps were held together by the clamping action between the cartridge chamber and the pistol cradle, and are now free to open. Through the action of the displacing springs, the three bombs are ejected from the cluster. The bomb tail-fuze arming wires are withdrawn when the cluster falls from the plane, and the bomb nose fuzes are free to arm after being ejected from the cluster, freeing their vanes from the fuze arming safety plate.

The air-arming delay-opening pistol requires approximately 45 turns to arm, and will allow the cluster to drop approximately ten feet below the releasing aircraft before functioning. Minimum release altitudes for these clusters are the same as those issued by the Chief of Naval Operations for bombs of the size used and fuzes installed plus twenty-five feet to allow for cluster opening. These clusters are safe for take-offs and landings anywhere, including catapult take-offs and arrested landing.

Cluster Adapter Mk 4 Mod 0

Bombs..........Two 100-pound G.P. bombs

General: The Cluster Adapter Mk 4 is a simplification of the Mk 3. It employs only the band and pistol release device to hold the bombs together. With the bombs clustered together, one of them is then suspended from the bomb rack by its suspension lug. The nose-fuze vanes are held stationary by two clips which are attached to wire springs. These springs are held between the bombs until the cluster opens, after which they are sprung free.

Cluster Adapter Mk 7 Mod 1

Bombs................Eight 20-pound Frag. Bombs, AN–M41A1
Total weight, pounds 186
Loaded length, inches.................46.38
Width, inches 8.36

General: This cluster—250-pound bomb size—uses the same pistol release device to open the cluster as used on the Mk 3; otherwise the mechanism is different. In this cluster, there is not only the release of the steel bands holding the bombs together but a spring-loaded force to push the bombs out of the cluster.

Description and operation: The frame has a front and a rear plate separated by the longitudinal members, the upper and lower rods. The lower rod is rigid, but the upper one is free to rotate. To this upper rod are fixed the band hooks. When the cluster is assembled, the hooks are under torque from the tension of the band. However, the band hooks are held stationary by a king pin swung between two supports, which supports are placed between the upper and the lower rods. Firing of the pistol device, seated in the front plate, knocks out this king pin, allowing the upper rod and hooks to rotate, freeing the bands.

When the bands fall off, the springs on the lower rod expand and, acting through the lever arms, push outboard on all the bomb cradles, forcing the bombs away from the cluster.

The arming vanes of the nose fuzes in the fragmentation bombs are kept from turning by safety arms attached to the front plate.

The cluster is suspended by the suspension plates in the middle part of the cluster.

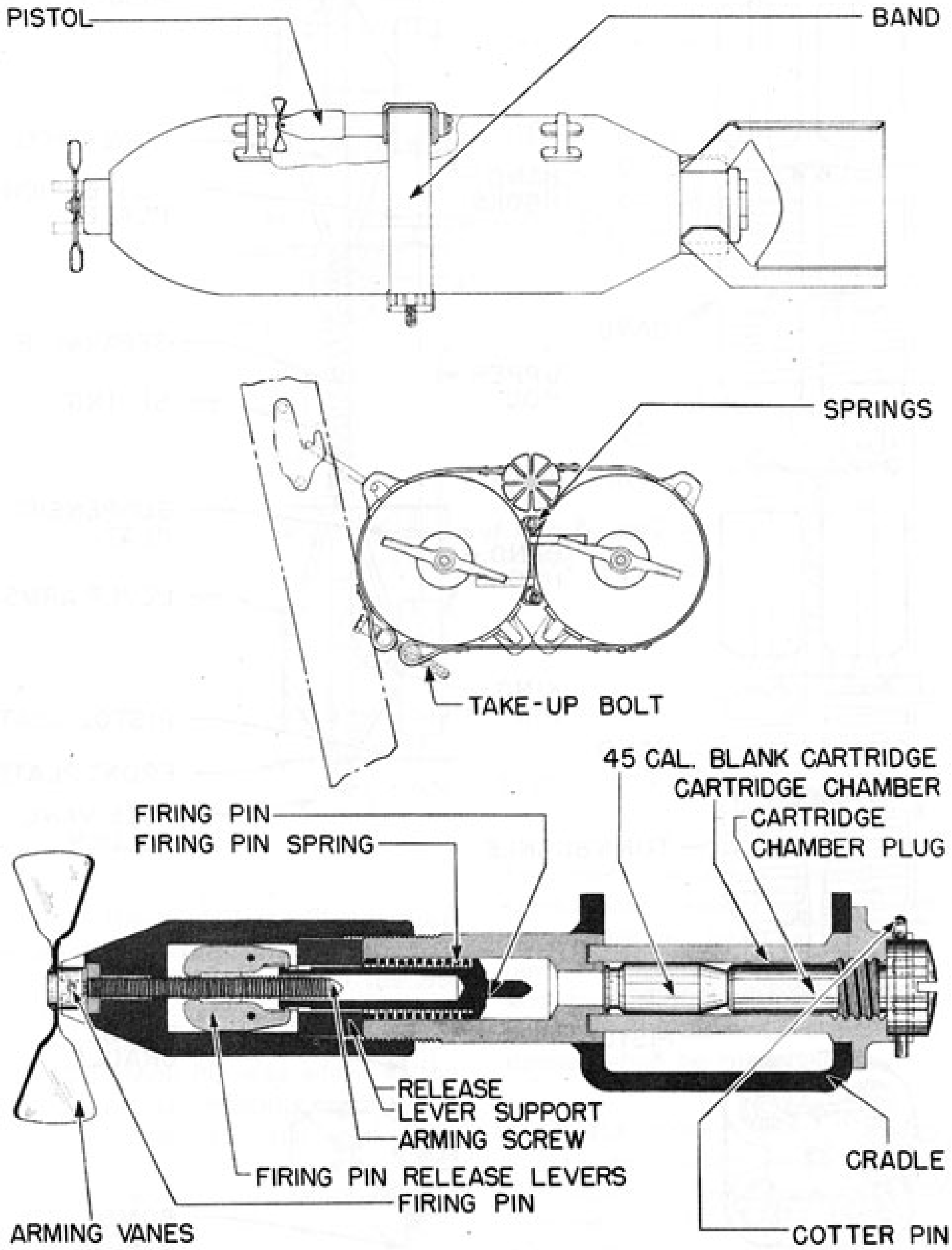


Figure 277. Cluster Adapter Mk 4 Mod 0

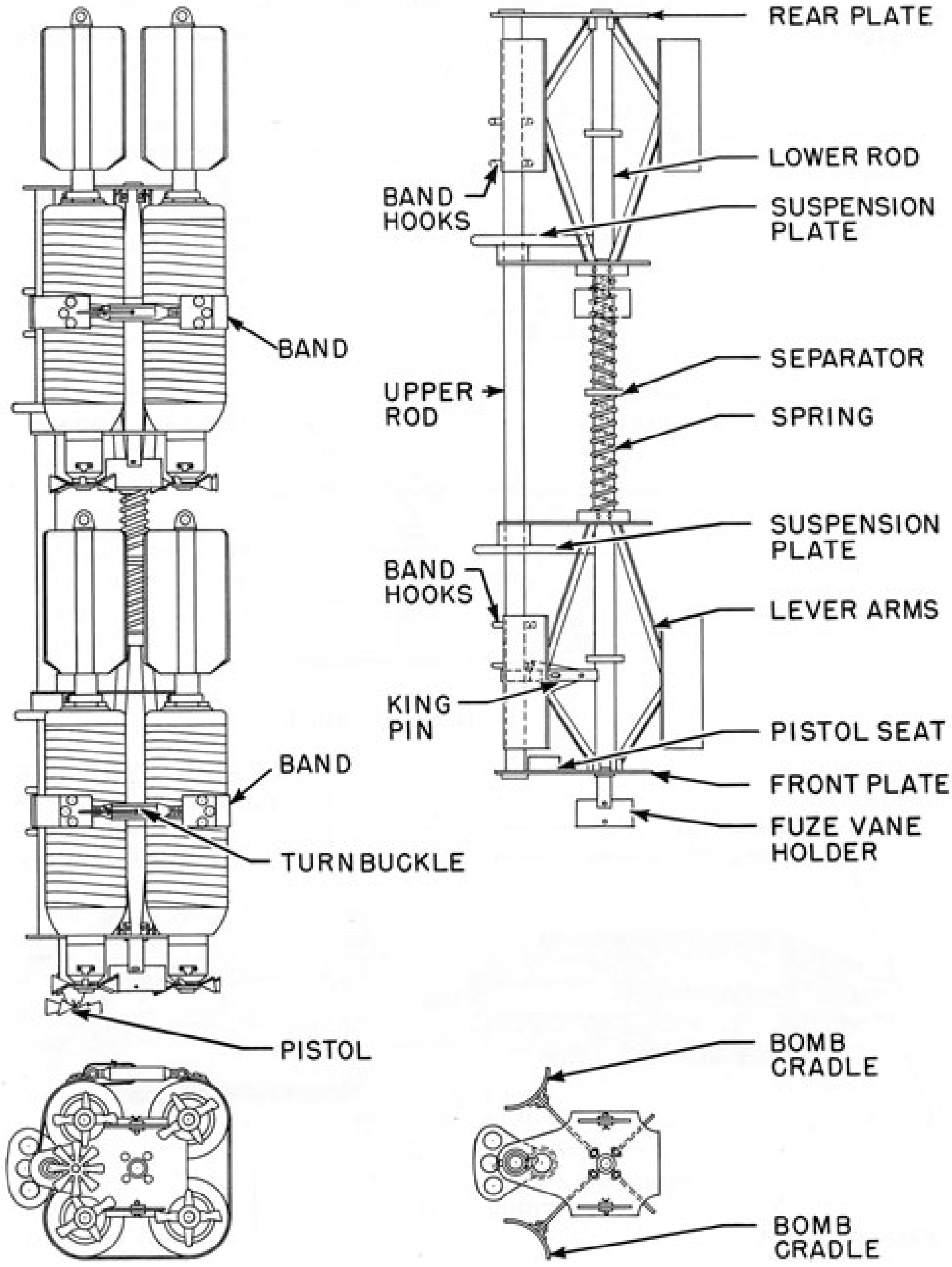


Figure 278. Cluster Adapter Mk 7 Mod 1

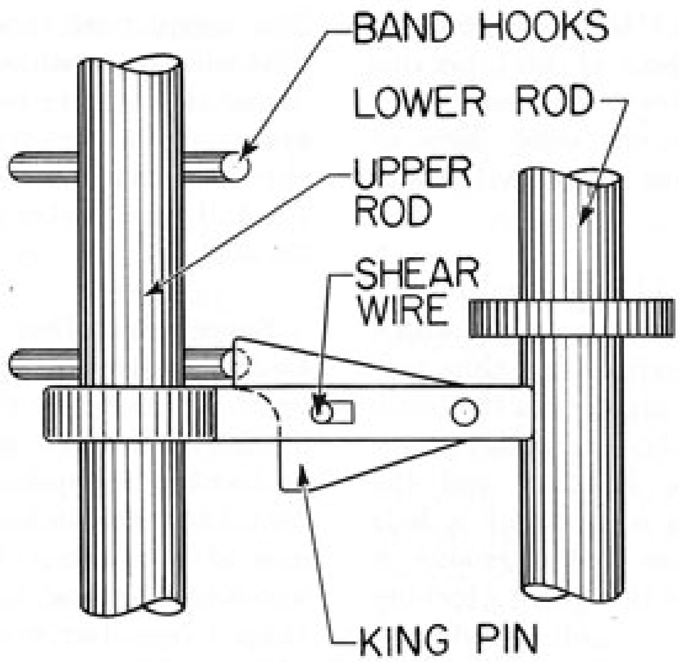


Figure 279. Close-up of King Pin on Cluster Adapter Mk 7 Mod 1

Part 6 — Chapter 17 — Section 5

"AN" SERIES

Introduction

The creation of the Army-Navy Standardization Board resulted in the standardization of the bombs of these two services into the AN series. This series was very similar to the M series except for these modifications:

1. A third suspension lug was added at the center of gravity and diametrically opposite the dual suspension lugs, to fit British release devices.

2. The base plate was changed to a male plug to increase the strength on low-angle penetration of targets.

3. The bombs were painted an over-all olive-drab with one-inch yellow bands around the nose and base and a ¼-inch yellow band around the center of gravity.

The bombs in this series included the following weights: 100, 250, 500, 1,000, and 2,000 pounds. These bombs are all general-purpose high-explosive bombs. Though other types of bombs — armor-piercing, semi-armor-piercing, fragmentation, incendiary, depth, etc.—have been subsequently standardized and given AN designations, it is with the AN general-purpose bombs and their modifications that this introduction shall be concerned.

AN G.P. Series: The AN series was subsequently replaced by the AN G.P. series to make it possible for these bombs to be used in anti-submarine work as well as for general bombardment. This modification was incorporated into the 500-, 1,000-, and 2,000-pound bombs only, their new designations becoming AN–M64, AN–M65, and AN–M66, and consisted of a change from the Adapter Booster M102 to the Adapter Booster M115. With the Adapter Booster M115 it became possible to use either standard Army tail fuzes or the Tail Hydrostatic Fuze AN–Mk

230. The standard filling of these bombs was 50/50 Amatol until the supply of TNT became ample in 1943, at which time TNT became the standard filler. At the present time, 25% of the production of these bombs is filled with Composition "B".

AN G.P. A1 Series: The A1 modification consists of two steel pins in the base plate which lock the base plate to the main filling, thus preventing removal of the base plate, once the bomb is filled. In this series the adapter boosters have also been modified to the M102A1 and the M115A1. This modification consists of a hole through the adapter booster and a groove in the threads of the base plate to receive a locking pin which is shipped with all anti-withdrawal tail fuzes. Insertion of the pin which is held in by the fuze body prevents withdrawal of the adapter booster. This series is the current production G.P. bomb series and is used jointly by the Army, Navy, and British forces.

The following table will assist in understanding the development of the designations that have been successively applied to general-purpose bombs used by the Army and Navy.

Body construction: The body construction of American G.P. bombs may be in one, two, or three pieces. Methods of manufacture include (1) one-piece cast or spun, (2) two-piece cast and welded or (3) three-piece cast and welded. The ogival nose tapers to join in the thin parallel side walls, which terminate in a boat-tailed shape at the after end. The threaded nose opening is closed by the fuze-seat liner, and the threaded base opening is closed by a male plug, the tail fuze pocket being made by the adapter booster.

Suspension: Dual suspension lugs for horizontal suspension are welded directly to the bomb case, being spaced 14 inches apart on bombs up to 2,000 pounds, and 30 inches apart on bombs 2,000 pounds and over. A single horizontal suspension lug is also welded to the bomb case at the center of gravity and diametrically opposite the dual lugs. The lugs are eyebolts, shaped from bar steel and formed in the shape of a U. "M" series bombs could be carried on single suspension racks by using an additional single-suspension lug welded on a band fitting around the bomb body at the center of gravity.

For suspension in dive-bomb displacement gear, trunnions are provided on a separate band which may be one of two types. The first type provides the trunnion only; and the second, a more common type, provides a single hoisting lug in addition to the trunnions. On some of the newer designs of AN bombs of Navy manufacture, the suspension and hoisting fittings are not attached to the bomb case by welding, but are held to the case by threaded bolts fitting into holes tapped and threaded into the body. For

GENERAL-PURPOSE BOMB DESIGNATIONS

Weight pounds	M Series	Navy	AN Series	AN G.P. Series	AN G.P. A1 Series
100	M30	Mk 4 Mod 4	AN–M30	AN–M30	AN–M30A1
250	M57		AN–M57	AN–M57	AN–M57A1
300	M31				
500	M43	Mk 12 Mod 2	AN–M43	AN–M64	AN–M64A1
600	M32				
1,000	M44	Mk 13 Mod 2	AN–M44	AN–M65	AN–M65A1
1,100	M33				
2,000	M34		AN–M34	AN–M66	AN–M66A1

suspension in torpedo slings, the torpedo sling guide key found on Navy bombs can be made on AN bombs by using the base of the single suspension lug with the lug removed by gentle hacksawing.

To hoist bombs into Navy planes, the AN bombs not equipped with hoisting lugs must have a hoisting lug furnished by either an expendable band with single or dual lugs, or by a removable hoisting band. The removable band is preferred, since it does not affect the terminal velocity of the bomb. The newest and best of these bands is the Universal Hoisting Band Mk 8. For Army planes, bombs are usually hoisted by canvas slings, which also have the advantage of not affecting air trajectory.

Tail fin construction: The tail construction is known as the box-type tail and consists of the following parts: a cast-steel sleeve secured to the body of the bomb by a fin locking nut, and four sheet-steel fins supported by four sheet-steel struts in the shape of a box. One fin and one strut are pressed from a single piece of metal, and the four pieces are then welded to the sleeve. "A" indicates heavier construction for high-altitude bombing.

Color and markings: The standard color scheme employed on these bombs since 11 March 1942 has been an olive drab body with yellow bands to indicate the H.E. filler. The banding system for Amatol and TNT fillers is a one-inch yellow band at the nose, a one-inch yellow band at the tail of the bomb body, and a 1/4-inch dotted band at the center of gravity. Because Composition "B" is more sensitive and requires more careful handling, it is given an additional marking consisting of a second one-inch yellow band at the nose and at the tail. On these bands "Comp. B" is stencilled in black paint. Recent production eliminates the 1/4-inch band, since the center of gravity is located accurately enough by the single suspension lug.

The following standard markings are painted on the bomb body in black paint: type, weight, and name of bomb, type of filling, lot number, place and date of filling, and inspector's initials.

Additional indestructible marking is stamped into the metal of the bomb case on the rear conical surface of the bomb body: type, size, name, maker's initials, lot number, and date (i.e., G.P. 500 lb. AN–M64 CSCO Lot 57 4/42).

Explosive filling: The filling of these bombs is accomplished in the following manner. With the nose-fuze seat liner in place, the bomb is placed on end nose-down and an Auxiliary Booster M104 is positioned behind it. The M104 is a bakelite tube containing tetryl pellets. The initial pour of the explosive is sufficient to secure the auxiliary booster when it cools. Then the remainder of the filling, 50/50 Amatol, TNT, or Composition "B", is added until a depth of approximately six inches remains to be filled. A second Auxiliary Booster M104 is then inserted in all bombs except the 100-pound, and the tail surround is added to complete the filling. A wooden former is inserted in the tail-fuze cavity as the filling cools. After cooling, the former is removed and the appropriate adapter booster is inserted. The adapter booster consists of the fuze-seat liner with an additional steel cup containing a tetryl pellet. The Adapter Booster M102 (and M102A1) has an internal thread diameter of 1.50 inches. The adapter Booster M115 has an internal thread diameter of 2.0 inches, and an adapter ring for further reduction of the diameter to 1.50 inches when smaller fuzes are used.

Tests conducted by the Army indicated that the presence or absence of Auxiliary Boosters M104 does not alter the effectiveness of the detonation of bombs. On the basis of these tests, the Army started to eliminate the Auxiliary Boosters M104 from Composition B loaded 500-pound, 1,000-pound, and 2,000-pound G.P. bombs during the latter part of 1944. Elimination of Auxiliary Boosters M104 in TNT and Tritonal loaded G.P. and S.A.P. bombs was started in March (TNT) and June (Tritonal) of 1945. At the present time, all productions of Composition "B," TNT and Tritonal loaded G.P. and S.A.P. bombs, and Composition B loaded Frag. bombs, exclude Auxiliary Boosters M104.

The bombs from which the Auxiliary Boosters M104 are now eliminated are as follows:

G.P.	S.A.P.	Frag.
(Comp. B, TNT or Tritonal Filling)	(TNT Filling)	(Comp. B Filling)
100# AN-M30A1	500# AN-M58A2	220# AN-M88
250# AN-M57A1	1,000# AN-M59A1	260# M81
500# AN-M64A1		
1,000# AN-M65A1		
2,000# AN-M66A2		

Tests conducted by the Army have shown that inert nose and tail surrounds improve safety in handling of G.P. and S.A.P. bombs. On the basis of these tests, the majority of G.P. and S.A.P. bombs loaded at the present time have inert nose and tail surrounds. This covers Composition B, TNT, Tritonal, and Picratol filled bombs. Formerly Composition B loaded bombs had TNT surrounds.

The ingredients of the inert surrounds used at present are as follows: ester gum, 51.0%; castor oil, 10.5%; kaolin, 34.5%; and wax, hydrocarbon, 4.0%.

The thickness of these surrounds is as follows:

G.P. Bombs		S.A.P. Bombs	
Nose	1¼″+¼″	Nose	Fills nose cavity and extends not more than ⅛″ beyond the bottom of the fuze seat liner.
Tail	¾″+¼″	Tail	¾″+¼″

The thickness of the surrounds is such that most, if not all, of the explosive portion of the adapter booster and that of the nose-fuze booster (surrounded by fuze seat liner) extends into the main filler, with exception of the S.A.P. nose set-up.

Anti-ricochet attachments: To give a more nearly vertical impact to 100-pound, 250-pound, and 500-pound G.P. bombs and to break their rapid descent when dropped from low-flying planes, the Anti-Ricochet Devices M16 and M17 have been developed. The device consists of a parachute unit, a modified AN-M112A1 series tail fuze (M151) using an anemometer-type arming vane, and a fuze adapter.

Clusters and cluster adapters: Properly, the cluster adapter is merely the containing device or holder. When the adapter is loaded with bombs, the entire assembly becomes a cluster. In some cases the cluster adapter may closely resemble a bomb in construction (e.g. M15 and M16), while in others the adapter is nothing more than a banding arrangement (AN-M1A1, AN-M4).

100-pound G.P. AN-M30 and AN-M30A1

Over-all length, inches	36.0	
Body length, inches	29.0	
Body diameter, inches	8.2	
Wall thickness, inch	0.16	
Tail length, inches	9.75	
Tail width, inches	11.0	
Tail weight, pounds	3.5	
Filling	50/50 Amatol	TNT
Weight of filling	54.0#	57.0#
Total weight	110.0#	115.0#
Charge/weight ratio	49%	50%

Fuzing—Regular missions

Nose: AN-M103, AN-103A1, M135, M135A1, M136, M136A1, M139, AN-M139A1, AN-M140A1, M140, M140A1, M149, M163, M164, M165, Mk 239, Mk 243-0, Mk 244-0.

Tail: AN-M100A2, AN-M100A1, M100, M160.

Fuzing—Special missions

Tail: M112, M112A1, (Masthead bombing from land base only).

M115 (Masthead from carrier or land base).

M123, M123A1, M132 (Long-delay time fuze against land targets).

M151 (Anti-ricochet).

Nose: Shipping plug when above fuzes are used in the tail.

Fuzing—V.T. missions

Nose: T50E1, M168, M166, T82.

Tail: AN-M100A2 (to insure detonation in event of V.T. fuze failure).

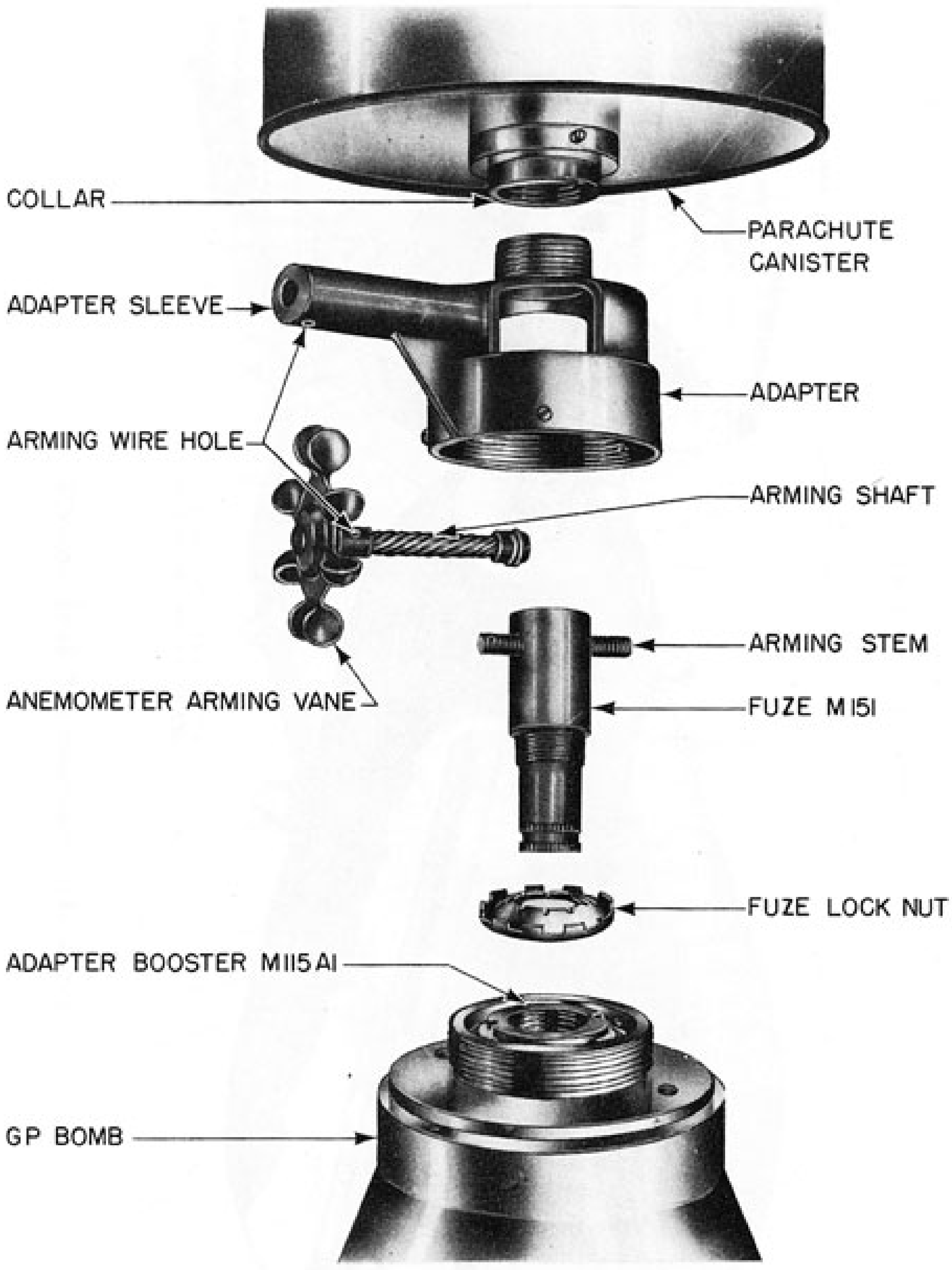


Figure 280. Components of Anti-Ricochet Parachute Assembly

Remarks: To overcome the erratic flight of these bombs when dropped from high altitudes by very heavy bombers, the tail assembly of the 260-pound Fragmentation Bomb M81 replaces the customary tail unit, which is two inches shorter, for such missions.

Use of the Cluster Adapter M22 permits single suspension for four G.P. Bombs AN–M30 or AN–M30A1.

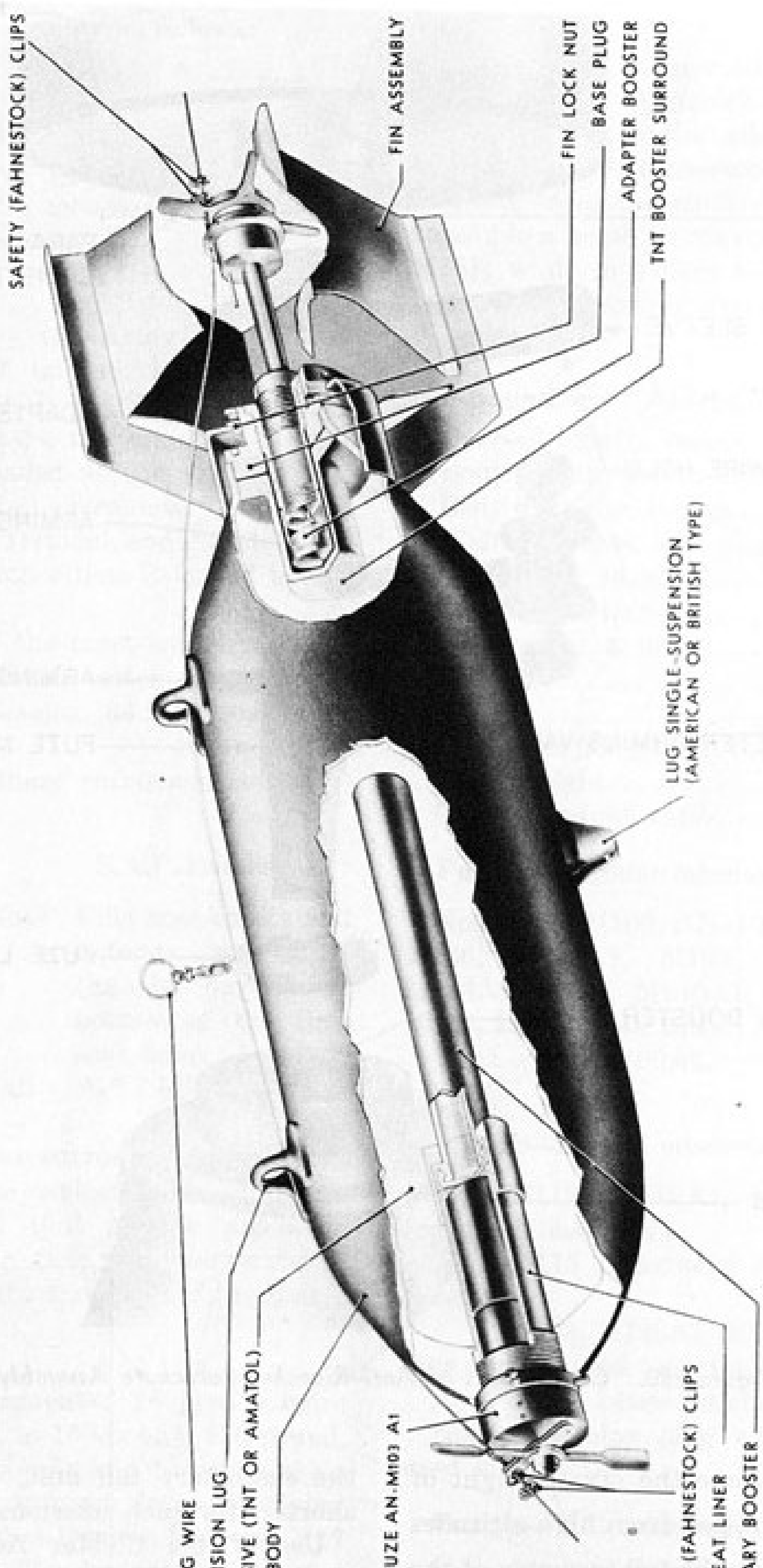


Figure 281. 100-pound G.P. Bomb AN-M30

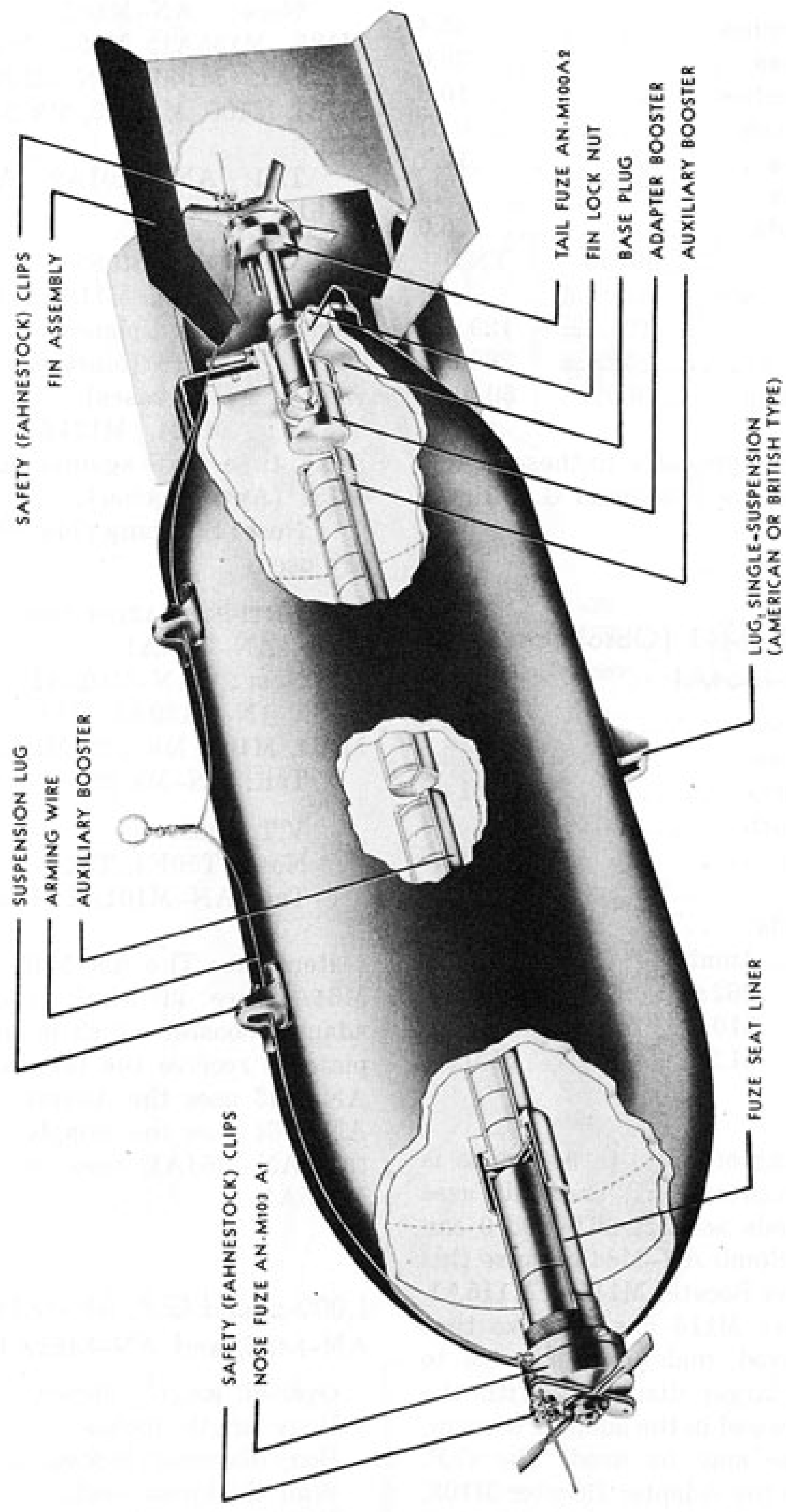


Figure 282. 250–pound G.P. Bomb AN–M57

250-pound G.P. AN–M57 and AN–M57A1

Over-all length, inches	45.4	
Body length, inches	36.0	
Body diameter, inches	10.9	
Wall thickness, inch	0.27	
Tail length, inches	12.1	
Tail width, inches	14.9	
Tail weight, pounds	6.0	
Filling	50/50 Amatol	TNT
Weight of filling	123.7#	129.0#
Total weight	255.9#	260.0#
Charge/weight ratio	48.0%	50.0%

Fuzing: Directions applicable to these bombs are the same as for the 100-pound G.P. Bomb AN–30.

500-pound G.P. AN–M43 (Obsolescent), AN–M64, and AN–M64A1

Over-all length, inches	56.8		
Body length, inches	45.0		
Body diameter, inches	14.2		
Wall thickness, inch	0.3		
Tail length, inches	13.9		
Tail width, inches	18.9		
Tail weight, pounds	12.3		
Filling	Amatol	TNT	Comp. B
Wt. of filling	262#	267#	274#
Total weight	510#	525#	535#
Chg./wt. ratio	51.2%	51.0%	51.0%

Fuzing: The fuzing of these three bombs is the same, with these exceptions: The Tail Fuzes AN–Mk 230 and Mods and Mk 231 Mod 0 can be used in the G.P. Bomb AN–M64 because this bomb has the Adapter Booster M115 or M115A1. The Adapter Booster M115 has a sleeve that can be easily removed, making it possible to use a fuze with a larger diameter. With the removable sleeve screwed in the adapter booster, any Army tail fuze may be used. The G.P. Bomb AN–M43 uses the Adapter Booster M102, which has no removable sleeve and therefore cannot take the Hydrostatic Fuzes AN–Mk 230 and Mk 231.

REGULAR MISSIONS

Nose: AN–M103, M103, AN–M103A1, M135, M135A1, M136, M136A1, M139, AN–M139A1, M140, AN–M140A1, M149, M163, M164, M165, Mk 243, Mk 244, Mk 239, AN–Mk 219.

Tail: AN–M101A2, AN–M101A1, M101, M161.

SPECIAL MISSIONS

Tail: M113, M113A1 (Masthead bombing from land based planes only).

M116 (Masthead bombing from carriers and land bases).

M124, M124A1, Mk 237–0 (Long-delay time fuze against land targets), M133, M151 (Anti-ricochet).

Nose: Shipping plug, when above tail fuzes are used.

ANTI-SUBMARINE MISSIONS (AN–M64, AN–M64A1)

Nose: AN–M103A1, AN–M103, M103, M139, AN–M139A1, M140, AN–M140A1, M163, M164, M165, Mk 239, Mk 243, Mk 244–0–1.

Tail: AN–Mk 230–4–5–6, Mk 231–0.

V.T. MISSIONS

Nose: T50E4, T82.

Tail: AN–M101A2 (Insurance).

Remarks: The AN–M43, AN–M64, and AN–M64A1 are identical types except for the adapter booster which is employed in the base plate to receive the tail fuze. The G.P. Bomb AN–M43 uses the Adapter Booster M102; the AN–M64 uses the Adapter Booster M115; and the AN–M64A1 uses the Adapter Booster M115A1.

1,000-pound G.P. AN–M44 (Obsolescent), AN–M65, and AN–M65A1

Over-all length, inches	67.1
Body length, inches	53.1
Body diameter, inches	18.8
Wall thickness, inch	0.5
Tail length, inches	18.5
Tail width, inches	25.4
Tail weight, pounds	21.5

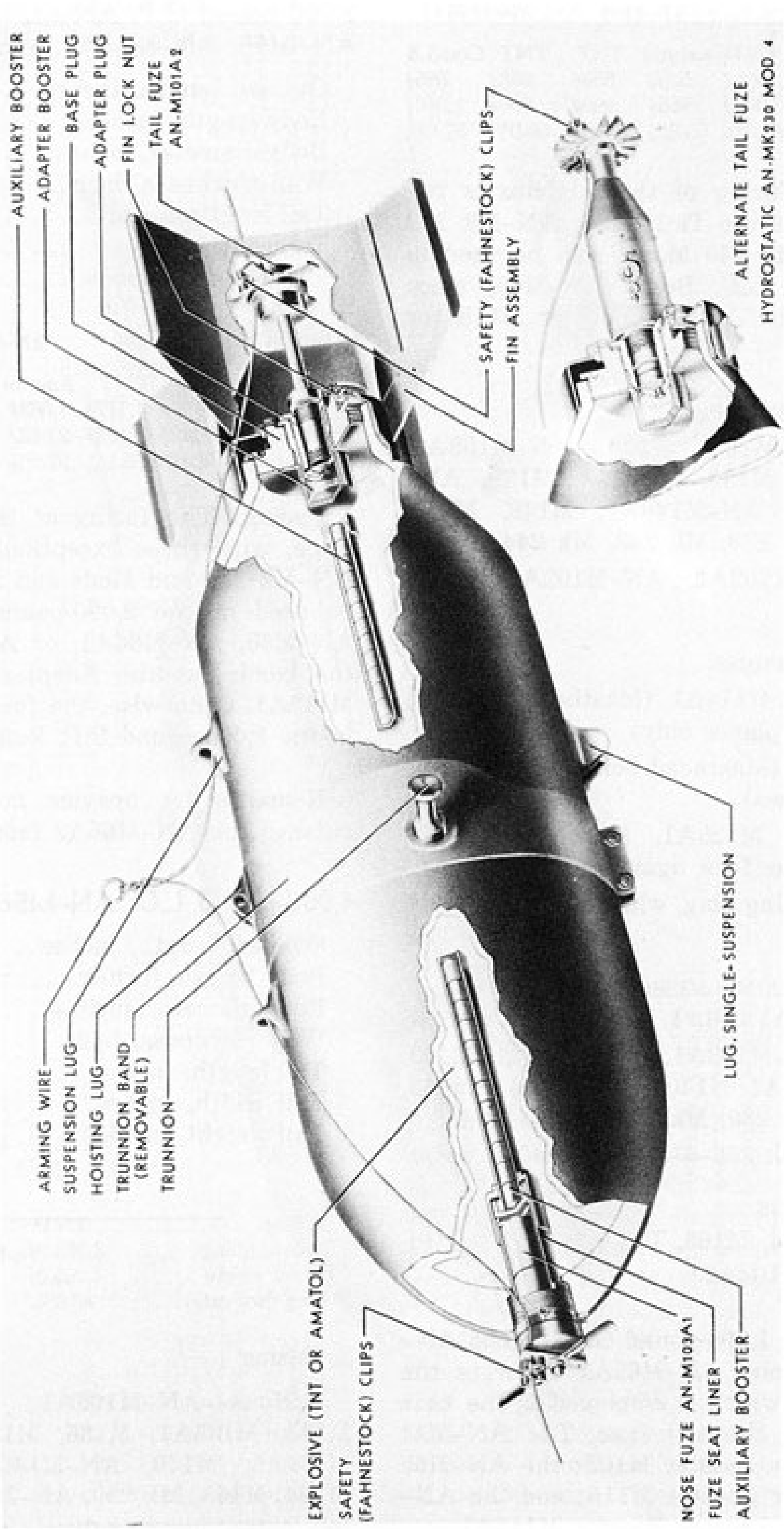


Figure 283. 500–pound G.P. Bomb AN–M64

	AN–M44		AN–M65		AN–M65A1	
Filling.....	Amatol	TNT	Amatol	TNT	TNT	Comp.B
Wt. of filling	530#	558#	530#	558#	558#	595#
Total weight	964#	990#	965#	990#	990#	1,040#
Chg./wt.ratio	54.9%	56.0%	55.8%	56.0%	56.0%	57.0%

Fuzing: The fuzing of these bombs is the same except that the Tail Fuzes AN–Mk 230 and Mods and Mk 240 Mod 0 can be used in the 1,000-pound G.P. Bomb AN–M65, since this bomb has the Adapter Booster M115 (or M115A1).

REGULAR MISSIONS

Nose: AN–M103, M103, AN–M103A1, M135, M135A1, M136, M136A1, M139, AN–M139A1, M140, AN–M140A1, M149, M163, M164, M165, Mk 239, Mk 243, Mk 244.

Tail: AN–M102A2, AN–M102A1, M102, M162.

SPECIAL MISSIONS

Tail: M114, M114A1 (Masthead bombing from land-based planes only).

M117 (Masthead bombing from carriers or land bases).

M125, M125A1, M134, Mk 238–0 (Long-delay time fuze against land targets).

Nose: Shipping plug, when above tail fuzes are used.

ANTI-SUBMARINE MISSIONS (AN–M65, AN–M65A1 ONLY)

Nose: AN–M103A1, AN–M103, M103, M139, AN–M139A1, M140, AN–M140A1, M163, M164, M165, Mk 239, Mk 243, Mk 244–0–1.

Tail: AN–Mk 230–4–5–6, Mk 240–0.

V.T. MISSIONS

Nose: T50E4, M166, T82.

Tail: AN–M102A2.

Remarks: The 1,000-pound G.P. Bombs AN–M44, AN–M65, and AN–M65A1 differ in the adapter booster which is employed in the base plate to receive the tail fuze. The AN–M44 uses the Adapter Booster M102; the AN–M65 uses the Adapter Booster M115; and the AN–M65A1 uses the Adapter Booster M115A1.

2,000-pound G.P. AN–M34 (Obsolescent), AN–M66, AN–M66A1, and AN–M66A2

Over-all length, inches	90.4
Body length, inches	70.0
Body diameter, inches	23.3
Wall thickness, inch	0.5
Tail length, inches	25.7
Tail width, inches	31.6
Tail weight, pounds	38.6

	AN–M34		AN–M66		AN–M66A1	
Filling.....	Amatol	TNT	Amatol	TNT	TNT	Comp.B
Wt. of filling	1,063#	1,117#	1,063#	1,117#	1,117#	1,142#
Total weight	2,049#	2,103#	2,052#	2,106#	2,106#	2,140#
Chg./wt.ratio	51.9%	53.1%	52.0%	53.0%	53.0%	53.3%

Fuzing: The fuzing of these bombs is the same, with these exceptions: The Tail Fuzes AN–Mk 230 and Mods and Mk 240 Mod 0 can be used in the 2,000-pound G.P. Bomb, the AN–M66, AN–M66A1, or AN–M66A2 because the bomb has the Adapter Booster M115 or M115A1. Otherwise, the fuzing is the same as in the 1,000-pound G.P. Bomb AN–M44.

Remarks: A heavier nose section distinguishes the AN–M66A2 from the AN–M66A1.

4,000-pound L.C. AN–M56 and AN–M56A1

Over-all length, inches	117.3
Body length, inches	94.9
Body diameter, inches	34.0
Wall thickness, inch	0.37
Tail length, inches	28.0
Tail width, inches	47.6
Tail weight, pounds	95.0

Filling............	TNT	Amatol	50/50 Amatol
Wt. of filling......	3,362.0#	3,245#	3,238#
Total weight......	4,205.0#	4,095#	4,232#
Chg./wt. ratio.....	80.0%	79.0%	76.5%

Fuzing

NOSE—AN–M103A1, AN–M103, M103, M135, M135A1, M136, M136A1, M139, AN–M139A1, M140, AN–M140A1, M149, M163, M164, M165, Mk 239, AN–Mk 219 (Always set for instantaneous action).

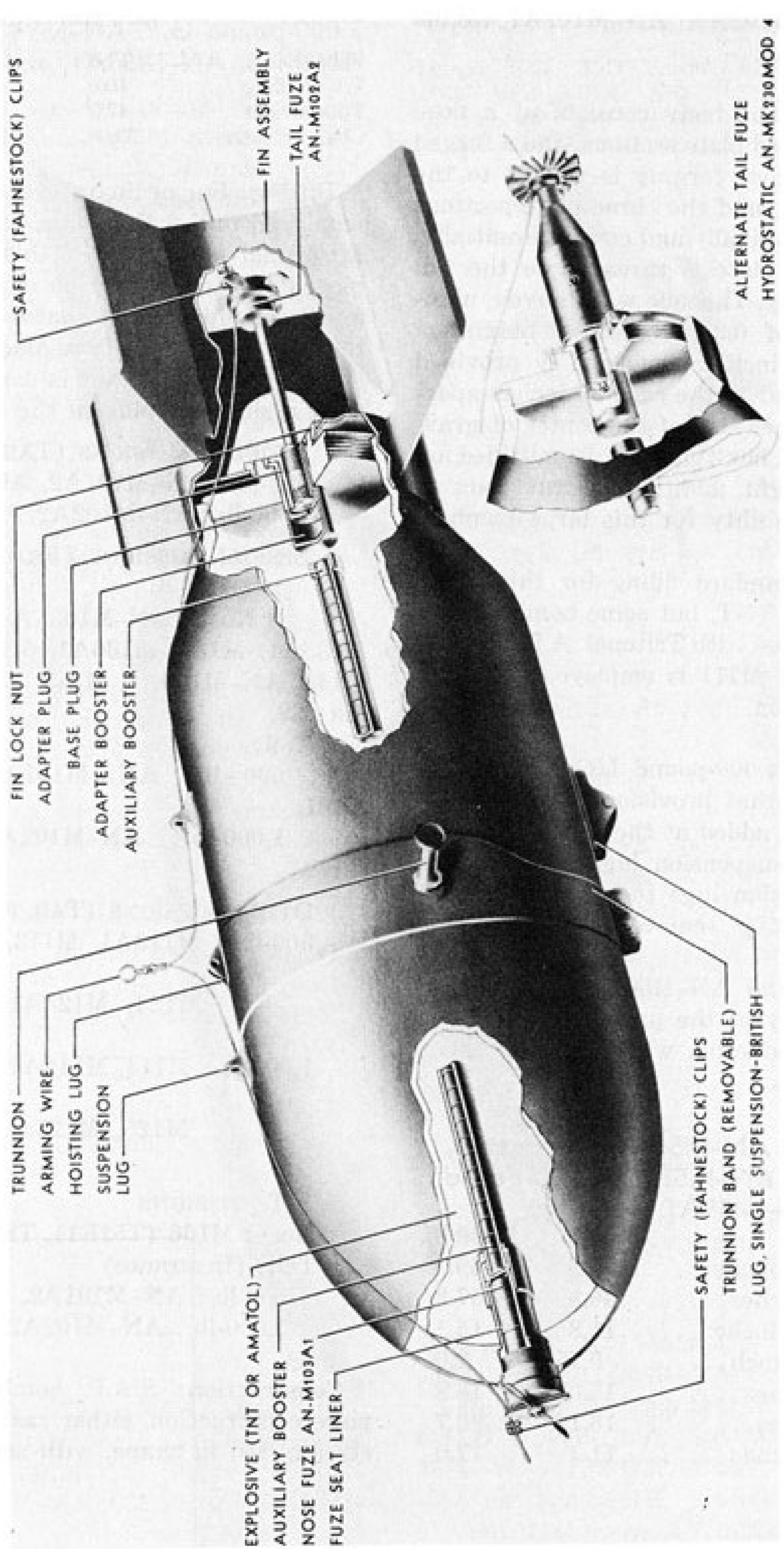


Figure 284. 1,000–pound G.P. Bomb AN–M65

TAIL—AN–M102A2, AN–M102A1, M162 (Non-delay action).

Construction: The body consists of a nose forging, three rolled plate sections, and a forged base plate. The nose forging is welded to the first plate section, and the three plate sections are welded longitudinally and circumferentially. The female base plate is threaded to the tail section of the body. The side walls have a minimum thickness of 0.3 inch and a maximum thickness of 0.5 inch. Suspension is provided by two lugs welded to the case 30 inches apart (15 inches on either side of the center of gravity). The normal box-type tail is modified on this bomb by eight additional strut rods to give increased stability for this large bomb.

Filling: The standard filling for this bomb at present is cast TNT, but some bombs in the future will be loaded with Tritonal. A full length Auxiliary Booster M111 is employed to insure complete detonation.

Remarks: The 4,000-pound L.C. Bomb AN–M56A1 differs in that provision is made for a hoisting lug to be added at the center of gravity between the suspension lugs and also for two other suspension lugs to be screwed into the bomb body, 22½° removed, for suspension in British planes.

The AN–M56 and AN–M56A1 are not procured by the Navy at the present time.

Any future production will have inert nose and tail surrounds.

S.A.P. 500-pound AN–M58 (Obsolescent), AN–M58A1, and AN–M58A2; 1,000-pound AN–M59 and AN–M59A1

	500 lb.	1,000 lb.
Over-all length, inches	57.8	69.3
Body length, inches	46.8	57.3
Body diameter, inches	11.8	15.1
Wall thickness, inch	0.75	1.0
Tail length, inches	15.05	16.8
Tail width, inches	16.18	20.7
Tail weight, pounds	11.4	17.0

	AN–M58	AN–M58A1	AN–M59
Filling	TNT	TNT	TNT
Wt. of filling	160#	162#	320#
Total weight	472#	494#	995#
Chg./wt. ratio	33.9%	33.0%	32.0%

Fuzing: For ordinary use, only tail fuzes are employed in S.A.P. bombs, but Nose Fuze AN–M103 and variations of this fuze can be employed for fragmentation effect, in which case a non-delay primer detonator is employed in the tail fuze. Otherwise, in regular missions a short-delay primer detonator is used in the tail fuze, with a shipping plug in the nose.

REGULAR MISSIONS (TAIL FUZED ONLY)
500-lb.: AN–M101A2, AN–M101A1, M161.
1,000-lb.: AN–M102A2, AN–M102A1, M162.

SPECIAL MISSIONS (FRAGMENTATION EFFECT)

Nose: AN–M103, AN–M103A1, M135, M135A1, M136, M136A1, M139, AN–M139A1, M140, AN–M140A1, M149, M163, M164, M165, Mk 239.

Tail:

500-lb.: AN–M101A2, AN–M101A1, M161.

1,000-lb.: AN–M102A2, AN–M102A1, M162.

OTHER MISSIONS (TAIL FUZED ONLY)
500-lb.: M113A1, M113, M116 (minimum altitude).
M124, M124A1, M133 (long-delay).
1,000-lb.: M114, M114A1, M117 (minimum altitude).
M125, M125A1, M134 (long-delay).

V.T. MISSIONS
Nose: M166 (T51E1), T82.
Tail: (Insurance)
500-lb.: AN–M101A2.
1,000-lb.: AN–M102A2.

Construction: S.A.P. bombs are of single-piece construction, either cast or spun, slightly streamlined in shape, with semi-pointed noses.

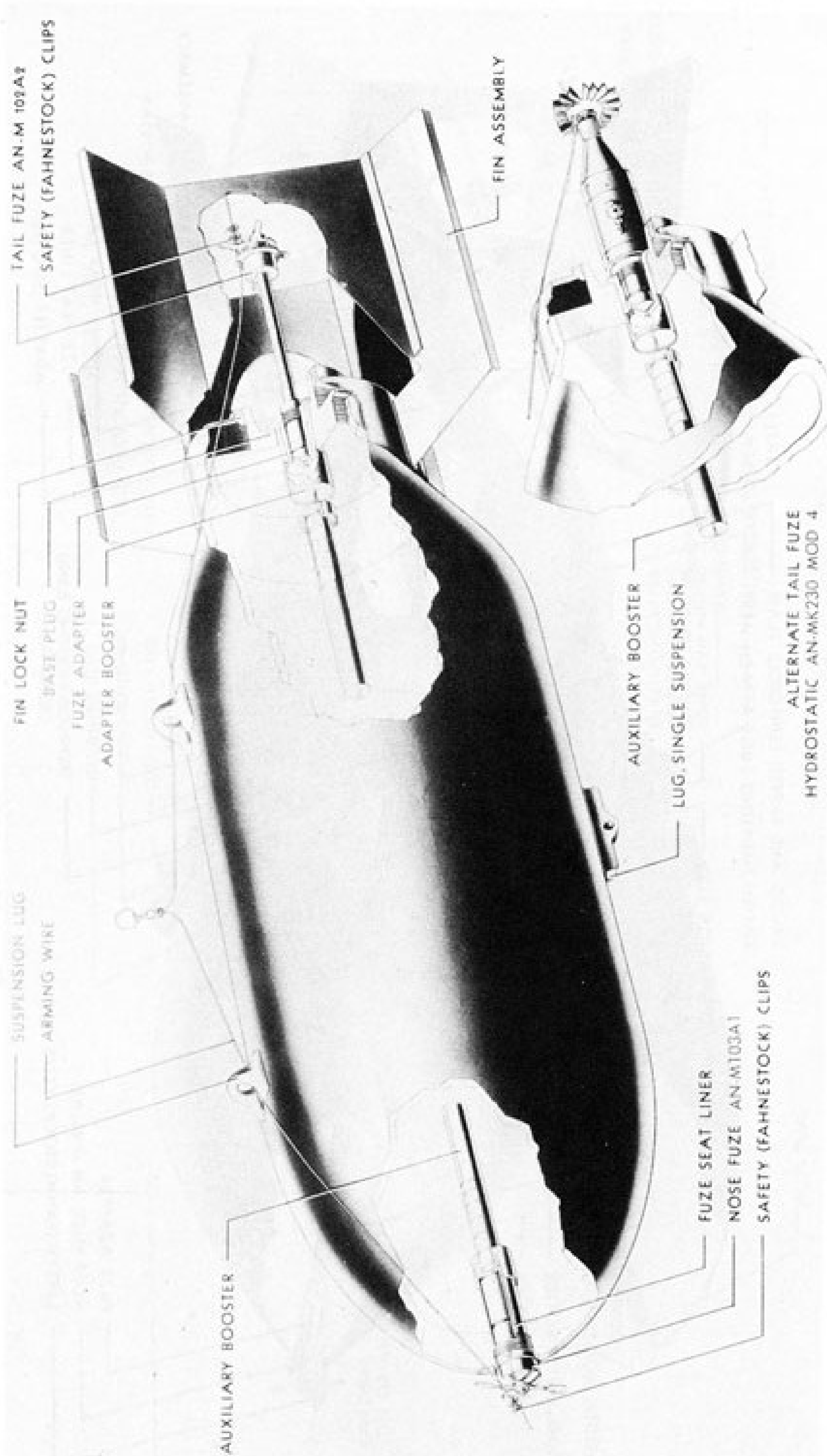


Figure 285. 2,000–pound G.P. Bomb AN– M66

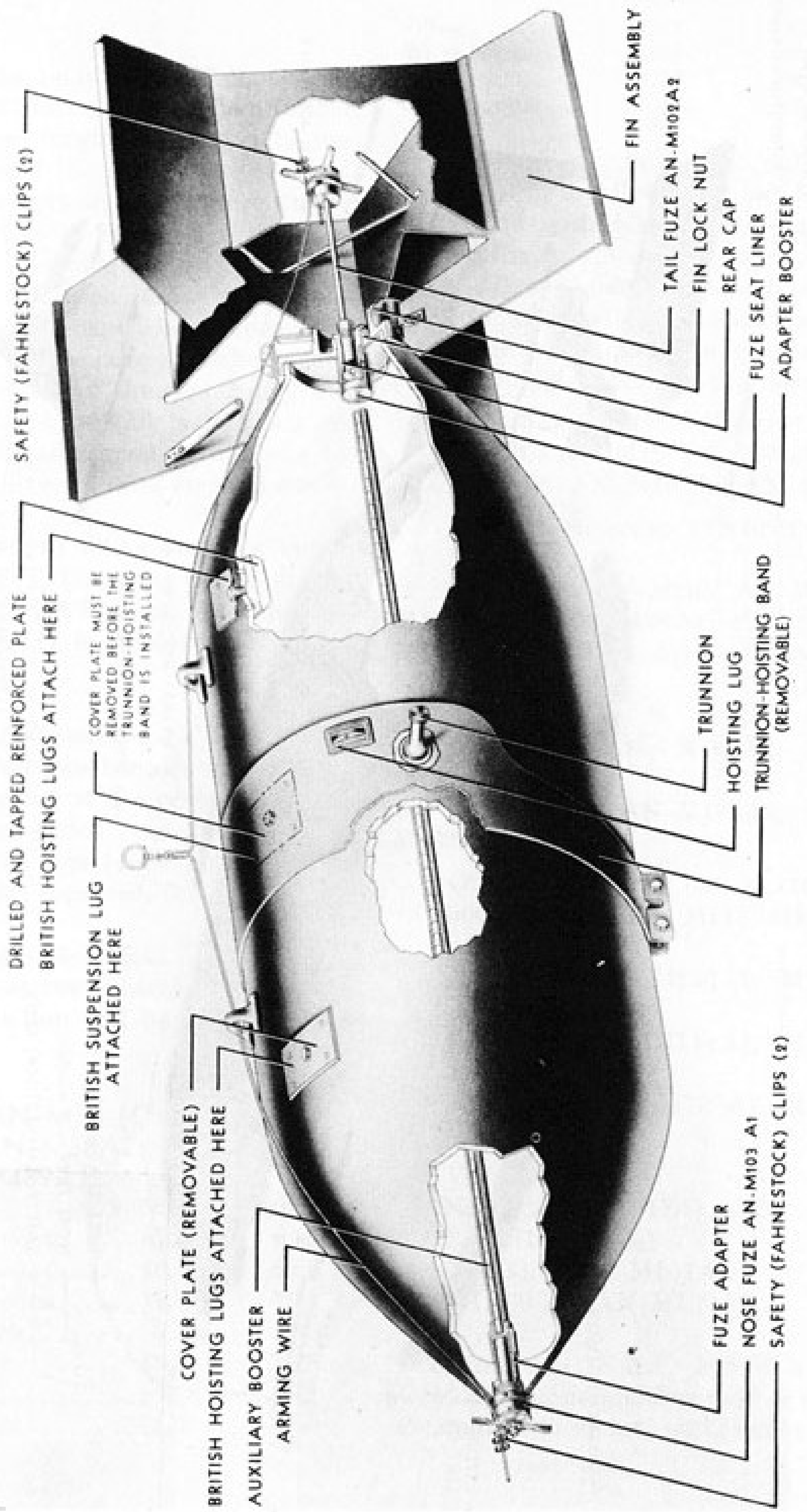


Figure 286. 4,000–pound L.C. Bomb AN–M56A1

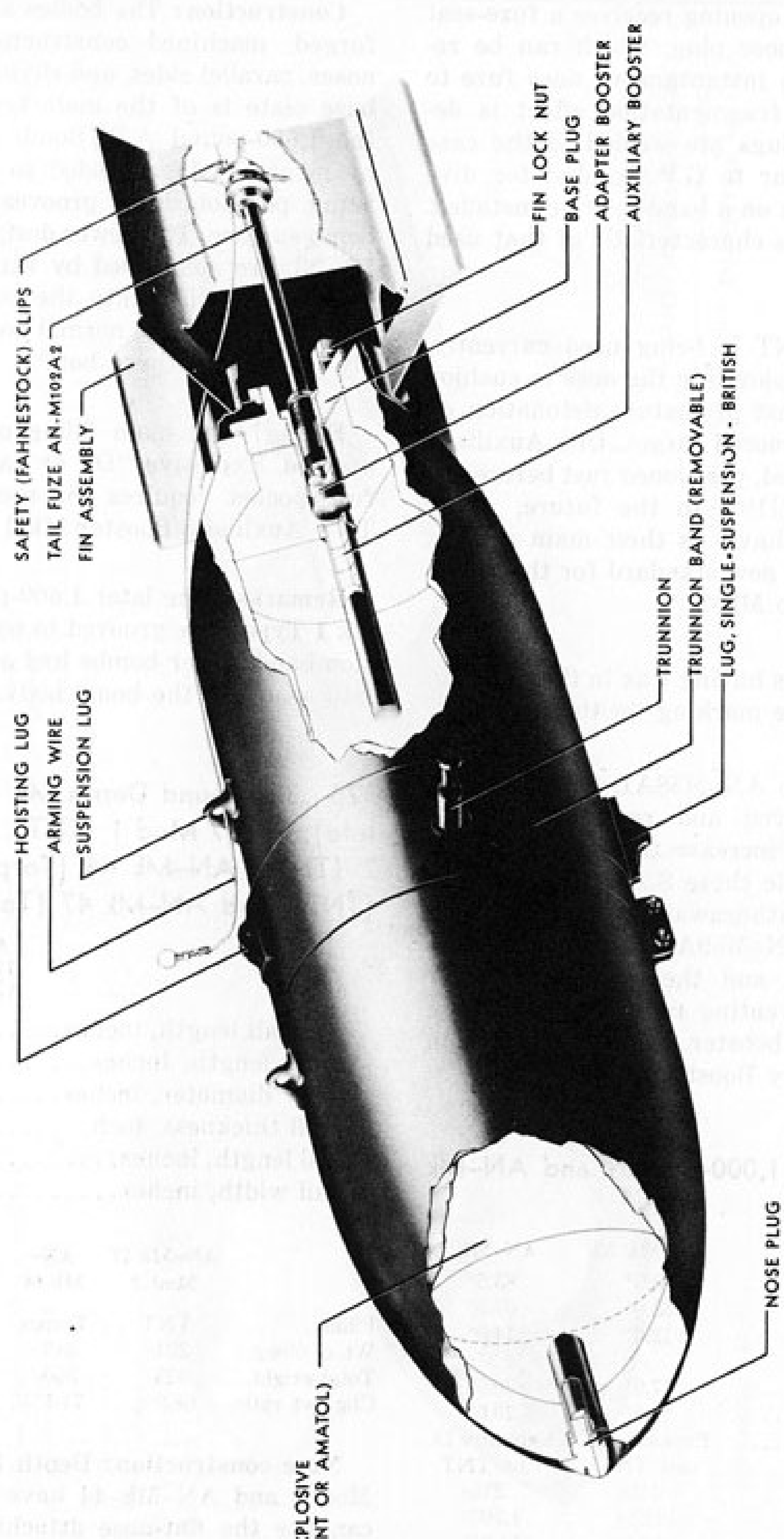


Figure 287. 1,000–pound S.A.P. Bomb AN–M59

The threaded nose opening receives a fuze-seat liner and a steel nose plug, which can be removed, allowing an instantaneous nose fuze to be inserted when fragmentation effect is desired. Suspension lugs are welded to the case in a manner similar to G.P. bombs; for dive bombing, trunnions on a band may be installed. The box-type tail is characteristic of that used on G.P. bombs.

Filling: Cast TNT is being used currently, with a wax pad employed in the nose to cushion the explosive against premature detonation on impact with an armored target. One Auxiliary Booster M104 is used, positioned just before the Adapter Booster M102. In the future, Army S.A.P. bombs will have, as their main charge, Picratol, the filling now standard for the 2,000-pound S.A.P. Bomb M103.

Markings: Bombs having wax in the nose can be identified by the marking "with pad."

Remarks: In the AN–M58A1, 9.5 pounds of Amatol are removed and replaced by 31.5 pounds of steel to increase the penetration of the bomb. To enable these S.A.P. bombs to be used with anti-withdrawal fuzes, the AN–M58A2 and the AN–M59A1 incorporate base-plate locking pins and the Adapter Booster M102A1, thus preventing removal of the base plate and adapter booster. Present production eliminates Auxiliary Booster M104.

A.P. AN–Mk 33 (1,000-pound) and AN–Mk 1 (1,600-pound)

	AN–Mk 33	AN–Mk 1
Over-all length	73.0"	83.5"
Body length	58.0"	69.5"
Body diameter	12.0"	14.0"
Wall thickness	—	1.3"
Tail length	17.0"	20.5"
Tail width	16.0"	20.6"
Filling	Explosive D, cast TNT	Explosive D, cast TNT
Weight of filling	140#	215#
Total weight	1,025#	1,590#
Charge/weight ratio	14.0%	14.0%
Fuzing	Tail—AN–Mk 228 (0.08 sec. delay)	

Construction: The bodies are of single-piece, forged, machined construction, with pointed noses, parallel sides, and slight boat tailing. The base plate is of the male type. Suspension in the 1,600-pound A.P. Bomb Mk 1 design was by means of lugs welded to bands, the bands being positioned by grooves on the external bomb surface. The newer designs, AN–Mk 1 and Mk 33, are suspended by fittings which screw into holes drilled into the bomb case and secured by bolts. The normal box-type tail assembly is used on these bombs.

Filling: The main filling of these bombs is pressed Explosive "D" or cast TNT. The tail fuze pocket requires the use of the granular TNT Auxiliary Booster Mk 1.

Remarks: The later 1,600-pound A.P. Bombs Mk 1 Type were grooved to position the suspension band. Older bombs had a stud which fitted into a hole in the bomb body.

325-, 350-pound Depth Mk 17 (TNT—Obsolete), Mk 17 Mod 1 (TNT), AN–Mk 17 Mod 2 (TNT), AN–Mk 44 (Torpex), AN–Mk 41 (TNT), and AN–Mk 47 (Torpex)

	AN–Mk 17 Mod 2 AN–Mk 44	AN–Mk 41 AN–Mk 47
Over-all length, inches	52.5	49.9
Body length, inches	31.1	27.8
Body diameter, inches	15.0	15.0
Wall thickness, inch	0.06	0.06
Tail length, inches	20.2	24.6
Tail width, inches	20.6	15.4

	AN–Mk 17 Mod 2	AN–Mk 44	AN–Mk 41	AN–Mk 47
Filling	TNT	Torpex	TNT	Torpex
Wt. of filling	224#	249#	227#	252#
Total weight	325#	350#	347#	355#
Chg./wt. ratio	68.9%	71.1%	65.4%	70.9%

Nose construction: Depth Bombs AN–Mk 17 Mod 2 and AN–Mk 44 have round noses, and can use the flat-nose attachment; AN–Mk 41 and AN–Mk 47 are flat nosed.

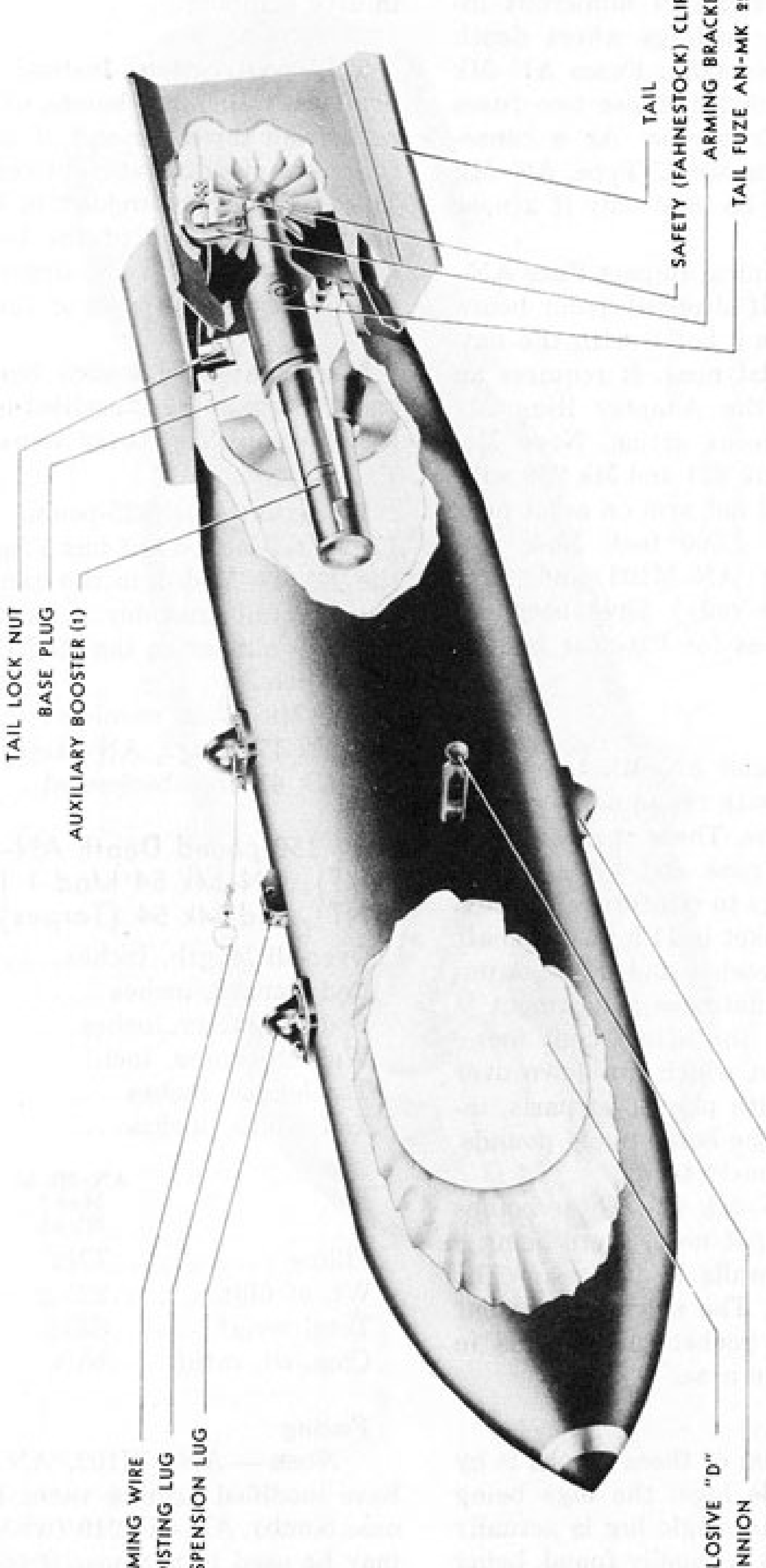


Figure 288. 1,000–pound A.P. Bomb AN–Mk 33

Fuzing

ATHWARTSHIP—Because of numerous instances in water crash landings where depth bombs fuzed with Athwartship Fuzes AN–Mk 224 or AN–Mk 234 exploded, these two fuzes have been suspended from use. As a consequence, the Depth Bombs Mk 17 Type, AN–Mk 41 and AN–Mk 44 may be used only if a nose impact fuze is installed.

NOSE—Nose Mechanical Impact Fuze AN–Mk 219 will not arm if dropped from below 2,500 feet when used on a bomb with the flat-nose attachment or a flat nose. It requires an auxiliary booster and the Adapter Ring Mk 219. It gives instantaneous action. Nose Mechanical Impact Fuzes Mk 221 and Mk 239 with delay of 0.01 second will not arm on a flat nose if dropped from below 2,500 feet. Nose Mechanical Impact Fuzes AN–M103 and AN–M103A1 (Instantaneous only) have been designed with special vanes for flat-nose bombs.

Body construction

AN–Mk 17 Mod 2 and AN–Mk 44—These depth bombs are made with round noses welded to a cylindrical steel tube. There is a strengthening disc around the nose and a steel strip along the suspension lugs to reinforce the body. The transverse fuze pocket is 11.9 inches abaft the nose. To prevent ricochet and improve underwater trajectory, a flat-nose attachment is made for these bombs, the attachment being in the shape of a bucket which fits down over the nose and is filled with plaster of paris, increasing the weight of the bomb by 44 pounds. The bomb case is extremely thin.

AN–Mk 41 and AN–Mk 47—These bombs are constructed with a flat nose, there being a slight taper from the walls to the nose. The body is in three pieces. The sides are tubular with a transverse fuze pocket tube welded in place 15 inches abaft the nose.

Suspension: Suspension of these bombs is by the usual dual or single lugs, the lugs being welded to the bomb. The single lug is actually somewhat different than is usually found, being in the form of a bracket rather than a lug. Trunnions on a band are for displacement gear in dive bombing.

Tail construction: Instead of employing the box-type tail, these bombs use a drum tail. As seen from the after end, it is circular and has four fins extending at right angles to each other. The fins are spot-welded to a cone which fits over the after end of the bomb. The fins are also spot-welded to the drum shroud. The tail is bolted onto the base of the bomb.

Markings: TNT-loaded bombs have weight and Mark number stencilled in yellow; Torpex-loaded bombs have these items stencilled in blue.

Remarks: The 325-pound Depth Bomb Mk 17 is TNT-loaded but has a light tail assembly; the Mk 17 Mod 1 is the same, except that a sturdier tail assembly is used. The AN–Mk 17 Mod 2 is similar to the Mod 1, but has a larger filling hole.

The Mk 17 is obsolete; the Mk 17 Mod 1, AN–Mk 17 Mod 2, AN–Mk 44, AN–Mk 47, and AN–Mk 41 are obsolescent.

325-, 350-pound Depth AN–Mk 53 Mod 1 (TNT), AN–Mk 54 Mod 1 (HBX), Mk 53 (TNT), and Mk 54 (Torpex)

Over-all length, inches	52.5
Body length, inches	33.25
Body diameter, inches	13.8
Wall thickness, inch	0.06
Tail length, inches	24.5
Tail width, inches	13.9

	AN–Mk 53 Mod 1 Mk 53	Mk 54	AN–Mk 54 Mod 1
Filling	TNT	Torpex	HBX
Wt. of filling	225#	250#	250#
Total weight	330#	354#	354#
Chg./wt. ratio	68%	70.6%	70%

Fuzing

NOSE — AN – M103, AN – M103A1 (must have modified arming vanes for use with flat-nose bomb). AN–Mk 219 (with an adapter ring) may be used in the nose if the AN–M103 with the modified vanes is not available. The AN–Mk

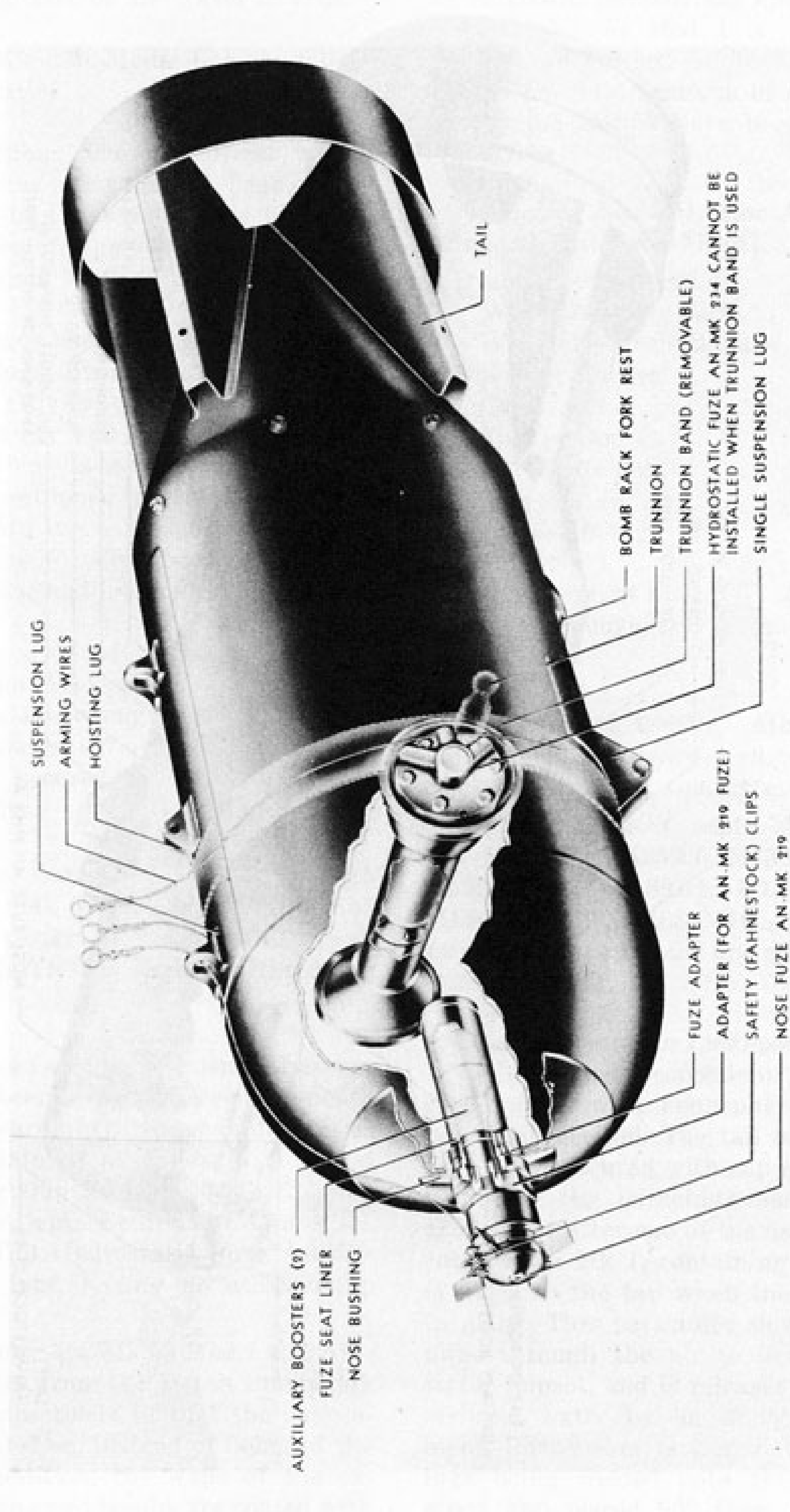


Figure 289. 325–pound Depth Bombs AN–Mk 17 Mod 2 and AN–Mk 44

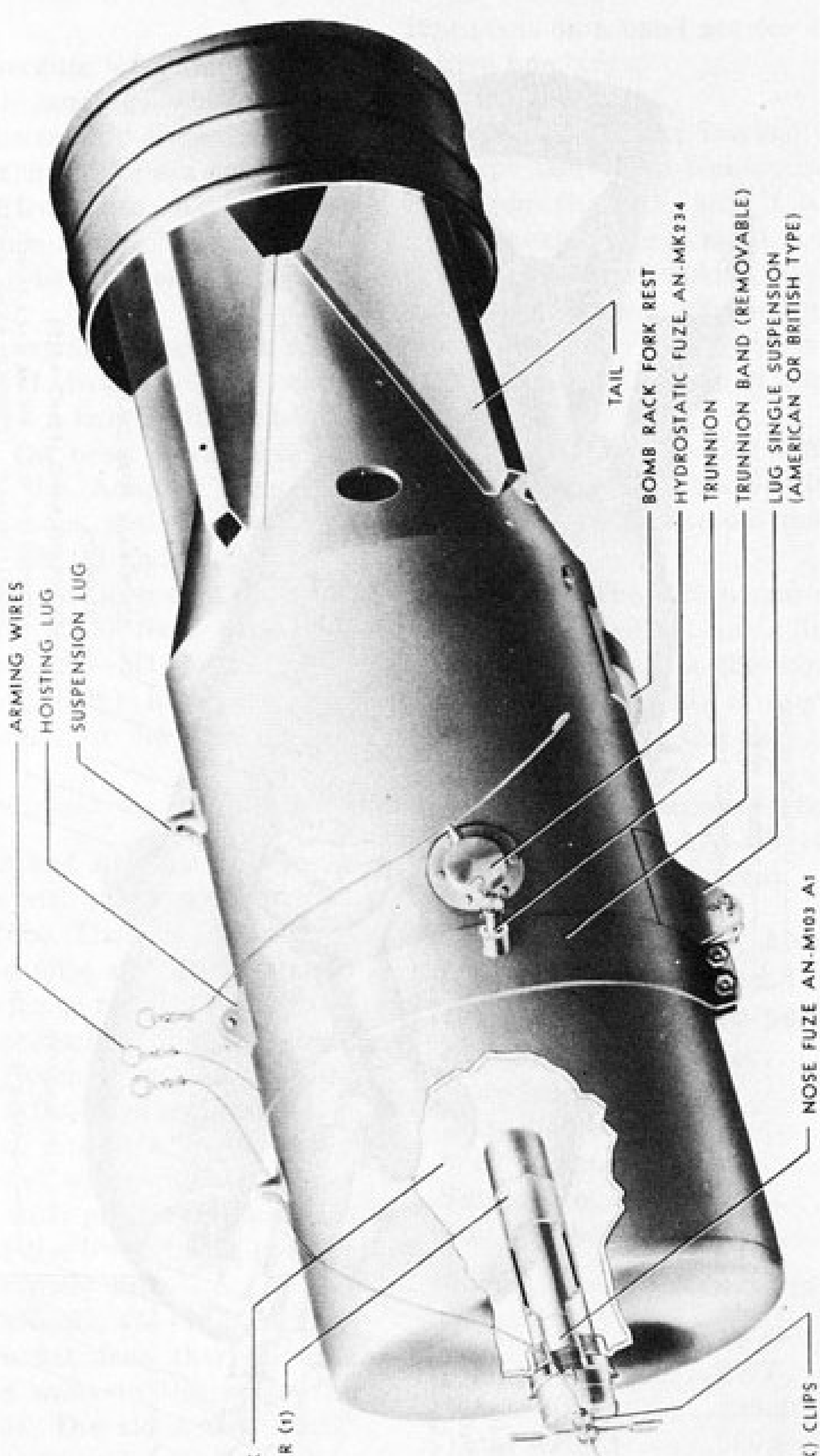


Figure 290. 325-pound Depth Bombs AN-Mk 41 and AN-Mk 47

219 requires 2,500 feet of air travel to arm.

TAIL—AN–Mk 230 Mods 4, 5, and 6 or Mk 231 (hydrostatic).

Body construction: The cylindrical welded sheet-steel body has a flat nose. A base closing plate is secured to the rear of the bomb by four bolts. A base closing plate is secured to the rear of the bomb by four bolts.

Suspension: These bombs are suspended horizontally by two lugs seven inches on each side of the center of gravity, or by a single lug at the center of gravity and 180° removed from the other lugs. There is no external band, the bombs being strengthened internally by a band which is fitted into the bomb at the center of gravity. Trunnions for dive bombing may be threaded to the case and internal strengthening band.

Tail construction: Welded to the tail cone are four vanes which are strengthened by interior box-type struts, and an exterior wide ring strut. The tail cone is secured to the base closing plate by four bolts.

Markings: Olive drab over all. "Mk 53—325 lb. depth bomb", "Mk 54—350 lb. depth bomb" stencilled on the respective bomb bodies in yellow if the filling is TNT, or in blue if the filling is Torpex.

Remarks: These two bombs (identical except for filling) have been designed to replace depth bombs using athwartship fuzes, since difficulties have been encountered at times in the past with the Athwartship Fuzes AN–Mk 224 and AN–Mk 234. The Depth Bombs Mk 53 and Mk 54 will use the Tail Hydrostatic Fuze AN–Mk 230 and a nose fuze, having no athwartship pocket.

The Depth Bombs AN–Mk 53 Mod 1 and AN–Mk 54 Mod 1 differ from the Depth Bombs Mk 53 and Mk 54 respectively in that the suspension lugs are welded on, instead of being of the screw type. In addition, the walls of the explosive cavity of the two bombs are coated with an asphaltic composition known as Hot Melt. The AN–Mk 54 Mod 1 is loaded with HBX rather than Torpex.

Only the modifications of the Depth Bombs Mk 53 and Mk 54 have been standardized as AN bombs.

1,000-pound Aircraft Mine AN–Mk 26 Mod 1 (Ground, Influence-Fired)

Over-all length, inches		
With parachute pack	68.5	
Without parachute pack	64.5	
Diameter, inches		
Case	18.625	
Tail section	15.75	
Parachute pack	18.50	
Filling	TNT	Torpex
Weight of filling	465#	525#
Total weight	1,000#	1,060#
Charge/weight ratio	46.5%	49.5%
Negative buoyancy	400#	460#

Fuzing

FOR USE AS A MINE—Athwartship—(Mine Mechanisms: forward well, clock starter and clock delay; after well, extender and booster.)

FOR USE AS A BOMB—Nose: AN–M103, AN–M103A1, M135A1, M136, M136A1, M139, M139A1, AN–M139A1, M140, M140A1, AN–M140A1, M149, M163, M164, M165, AN–Mk 219 (with adapter ring and one additional Auxiliary Booster Mk 1).

Construction: The 1,000-pound Aircraft Mine AN–Mk 26 Mod 1 consists of a cylindrical steel case welded with hemispherical nose and tapered tail section. The tail is closed by a concave cover secured with cap screws. A ring for mounting the parachute assembly is welded around the after end of the case. The Tail Parachute Pack Mk 1, containing Parachute Mk 2, is fitted to the tail when the mine is installed in plane. This parachute slows the fall of the mine through the air to lessen the shock of water impact, and is released from the case on striking water by an impact release mechanism. Suspension is horizontal, two standard lugs being welded onto the body 14 inches apart and placed 90° from the side pockets.

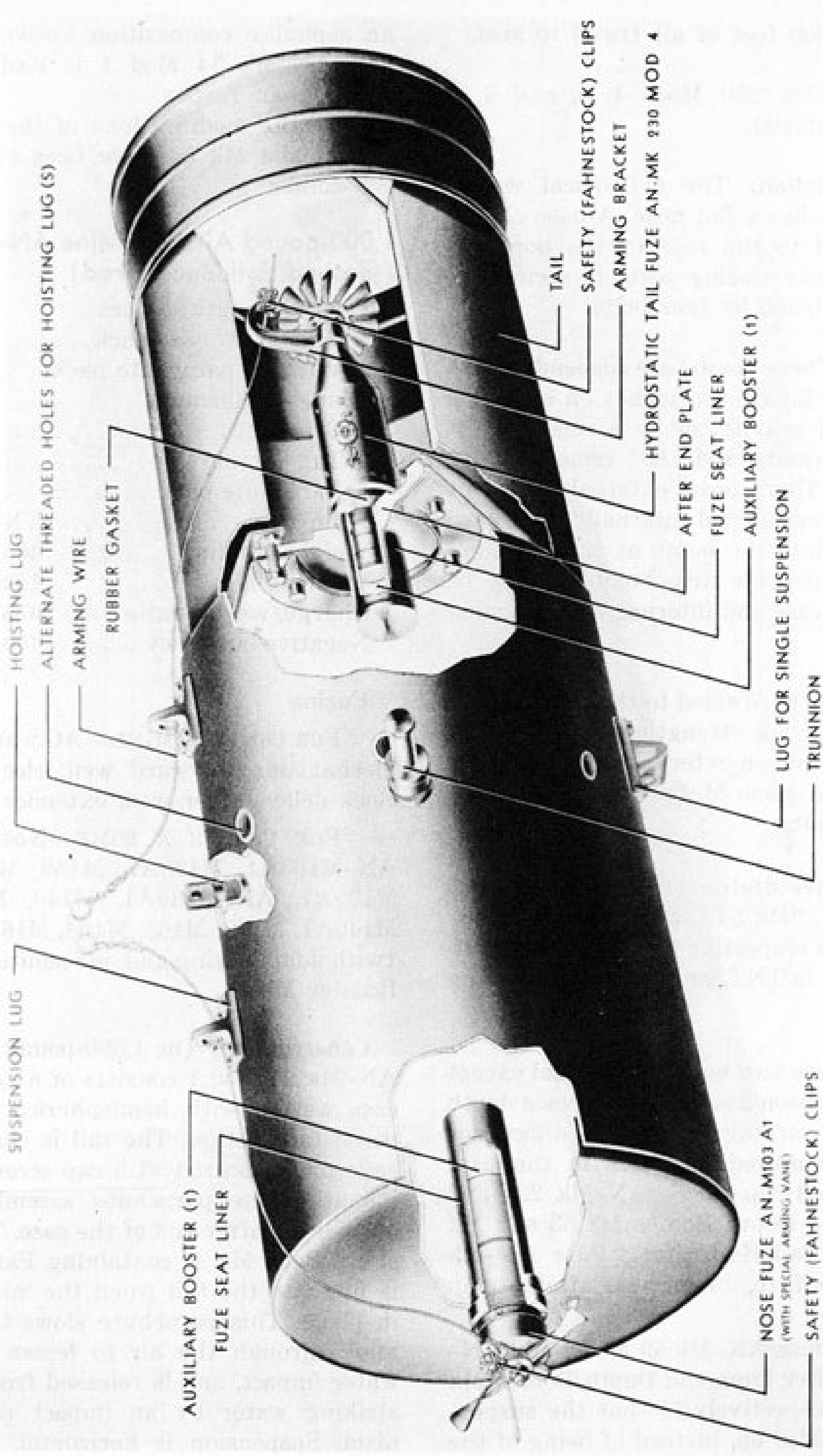


Figure 291. 325-pound Depth Bombs AN-Mk 53 and AN-Mk 54

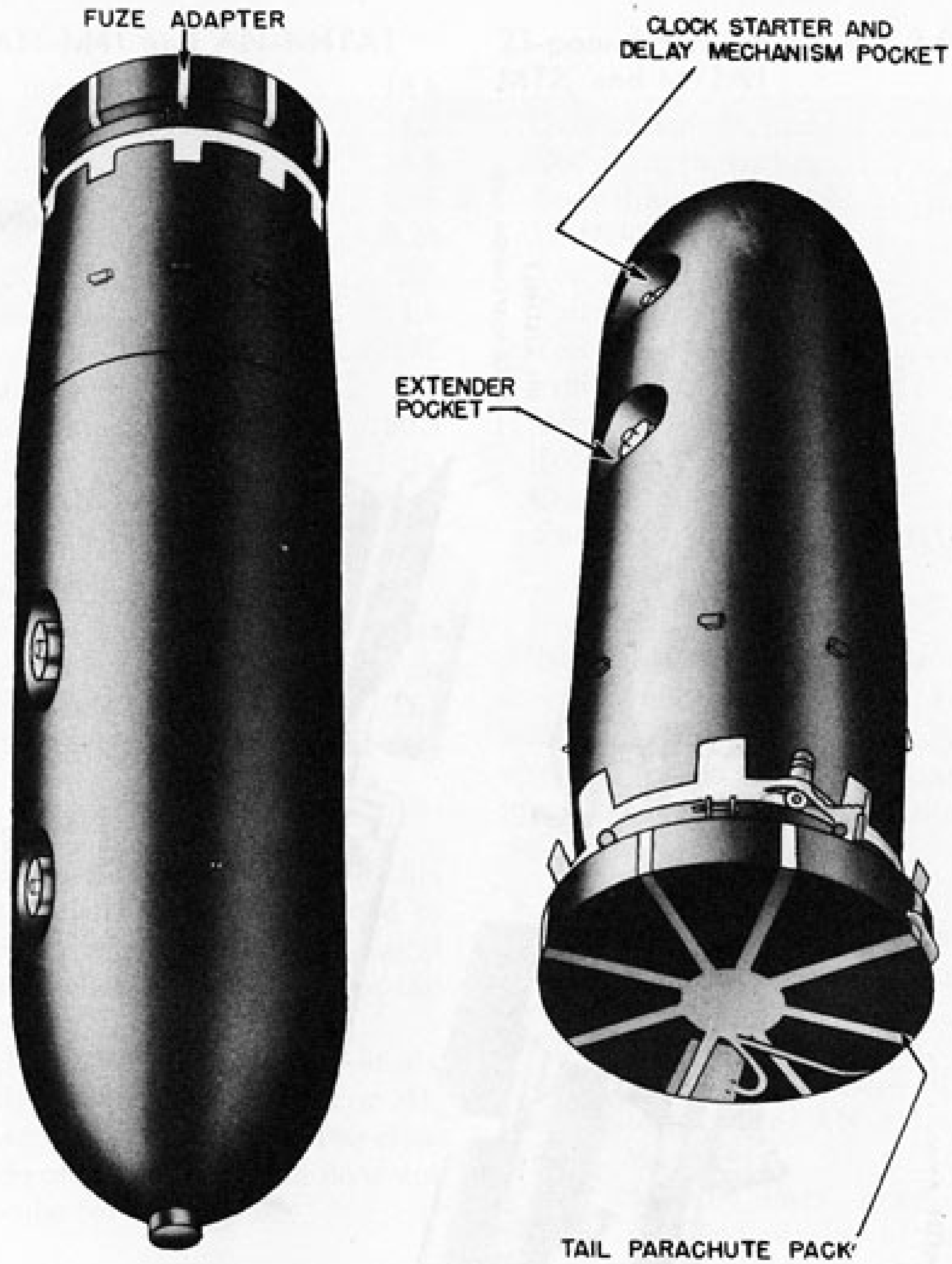


Figure 292. 1,000–pound Aircraft Mine AN–Mk 26 Mod 1

There is a removable British single-suspension lug 180° removed.

Color: Black over all.

Remarks

NORMAL USE—As ground, magnetic induction mine (Search Coil Firing Mechanism M–9–1). Aircraft-laid, with parachute (release altitude—200 feet or higher). Laid offensively in depths of water from 16 feet to 120 feet against surface craft, and up to 500 feet against submarines. Extender and clock starter are caused to function by hydrostatic pressure at depths of 16 feet or greater. Clock delay runs off in 170 minutes to arm the mine.

USE AS BOMB—This mine is poorly suited for use as a bomb, since accurate dropping by parachute is difficult; and if parachute is not used, the case tumbles. Fuzes require longer air travel to arm than usual, because of the shape of the mine and the manner of fall through the air.

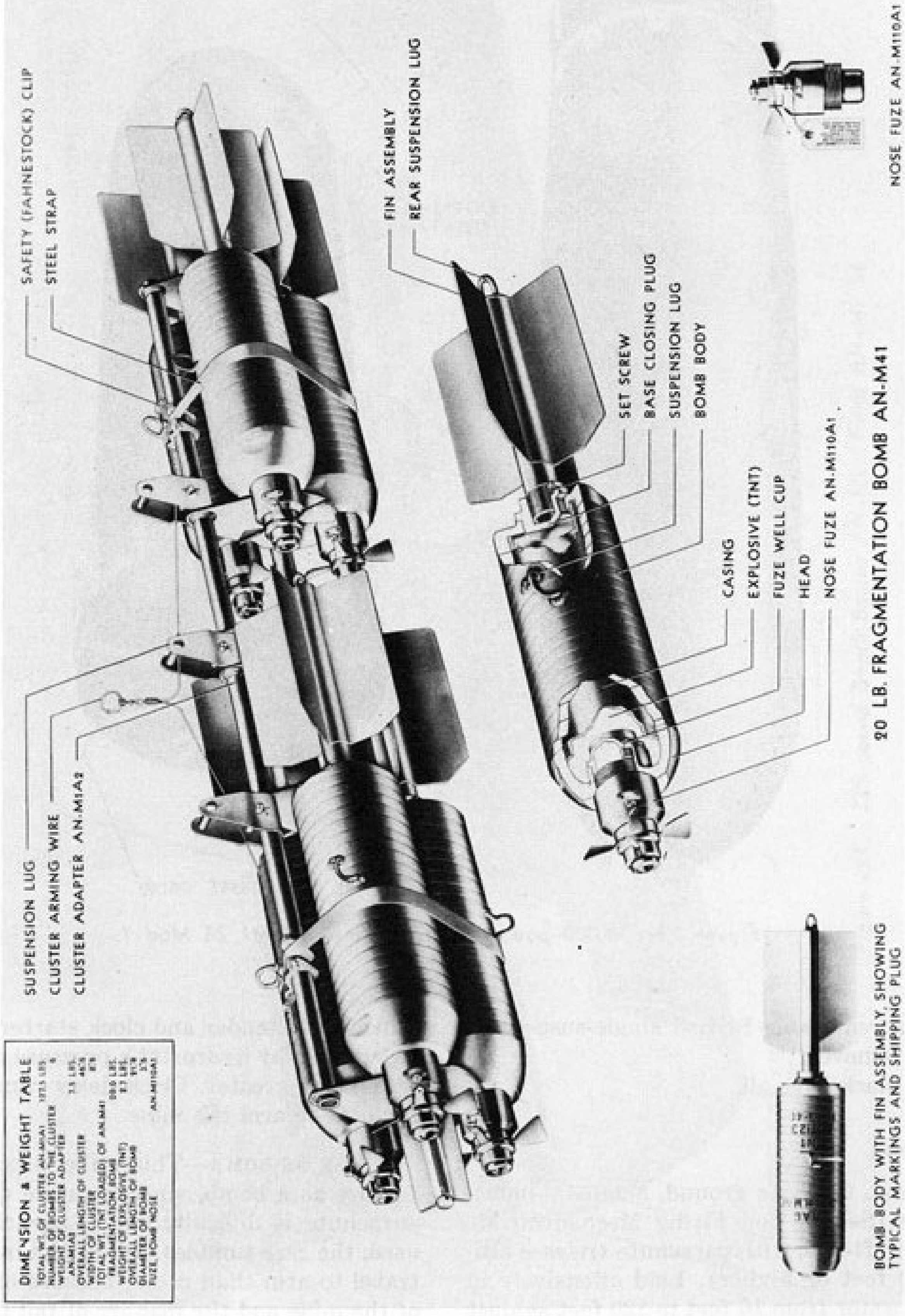


Figure 293. 20–pound Frag. Bombs in Cluster AN–M1A1

20-pound Frag. AN–M41 and AN–M41A1

Over-all length, inches	19.5
Body length, inches	11.3
Body diameter, inches	3.6
Wall thickness, inch	0.56
Tail length, inches	9.25
Tail width, inches	5.1
Tail weight, pounds	1.6
Filling	TNT
Weight of filling, pounds	2.7
Total weight, pounds	20.3
Charge/weight ratio	13%
Fuzing	M158, AN–M110A1, M110, M109

Body construction: This bomb is constructed of cast-steel nose and tail pieces, a seamless steel inner tube, and a helically-wrapped drawn steel wire wrapping around the inner tube. The tube is threaded to hold the nose and tail sections.

Suspension: For individual suspension of this bomb, a U-shaped eyebolt of steel is welded to the body at the center of gravity for horizontal suspension, and an eyebolt is welded to the tail for vertical suspension.

The bomb may be dropped in a cluster of six bombs in the Cluster Adapter AN–M1A2 or M1, forming the Cluster AN–M1A1 or M1. The cluster adapter is made of sheet steel, and does not use eyebolts of bombs for suspension.

Tail Construction: Four rectangular sheet-steel vanes are welded to a length of one-inch cast-iron pipe which screws into the base filling plug.

Remarks: This bomb is a high-level fragmentation bomb and should be dropped from a minimum altitude of 400 feet.

The A1 modification of this bomb consists of adding a 1½-inch shoulder around the nose to facilitate clustering with unfuzed bombs. Heretofore, the spacers of the cluster adapter have fitted against the fuze, thereby making it requisite that the bombs be clustered and shipped with fuzes inserted.

23-pound Para.–Frag. AN–M40, AN–M40A1, M72, and M72A1

Over-all length, inches	26.7
Body length, inches	11.3
Body diameter, inches	3.6
Wall thickness, inch	0.56
Tail length, inches	13.9
Tail width, inches	4.35
Tail weight, pounds	5.3
Filling	TNT
Weight of filling, pounds	2.7
Total weight, pounds	24.5
Charge/weight ratio	11.0%
Fuzing	M170, AN–M120A1, AN–M120, AN–M104.

Body construction: These bombs are constructed of cast-steel nose and tail pieces, a seamless steel inner tube, and a helically-wrapped drawn steel wire wrapping around the inner tube. The tube is threaded to hold the nose and tail sections.

Suspension: For individual suspension of these bombs, a U-shaped eyebolt of steel is welded to bomb at the center of gravity.

The 23-pound Para.–Frag. Bombs AN–M40 are always clustered, three of the bombs with the Cluster Adapter AN–M3 forming the Cluster AN–M4.

The 23-pound Para.–Frag. Bomb M72 is a slightly modified version of the AN–M40. It is adapted for individual suspension and can be carried in vertical cellular racks by several types of Army planes.

Tail construction: The 23-pound Para.–Frag. Bombs AN–M40 and M72 are fitted with cylindrical sheet-steel parachute housings which have end caps at the rear end and contain a white silk parachute. The Parachute Unit M3 is used in the Para.–Frag. Bombs AN–M40 and AN–M40A1; the Parachute Unit M4 in the Para.–Frag. Bombs M72 and M72A1.

Remarks: The AN–M40 and M72 are low-level fragmentation bombs and should be dropped from a maximum altitude of 400 feet.

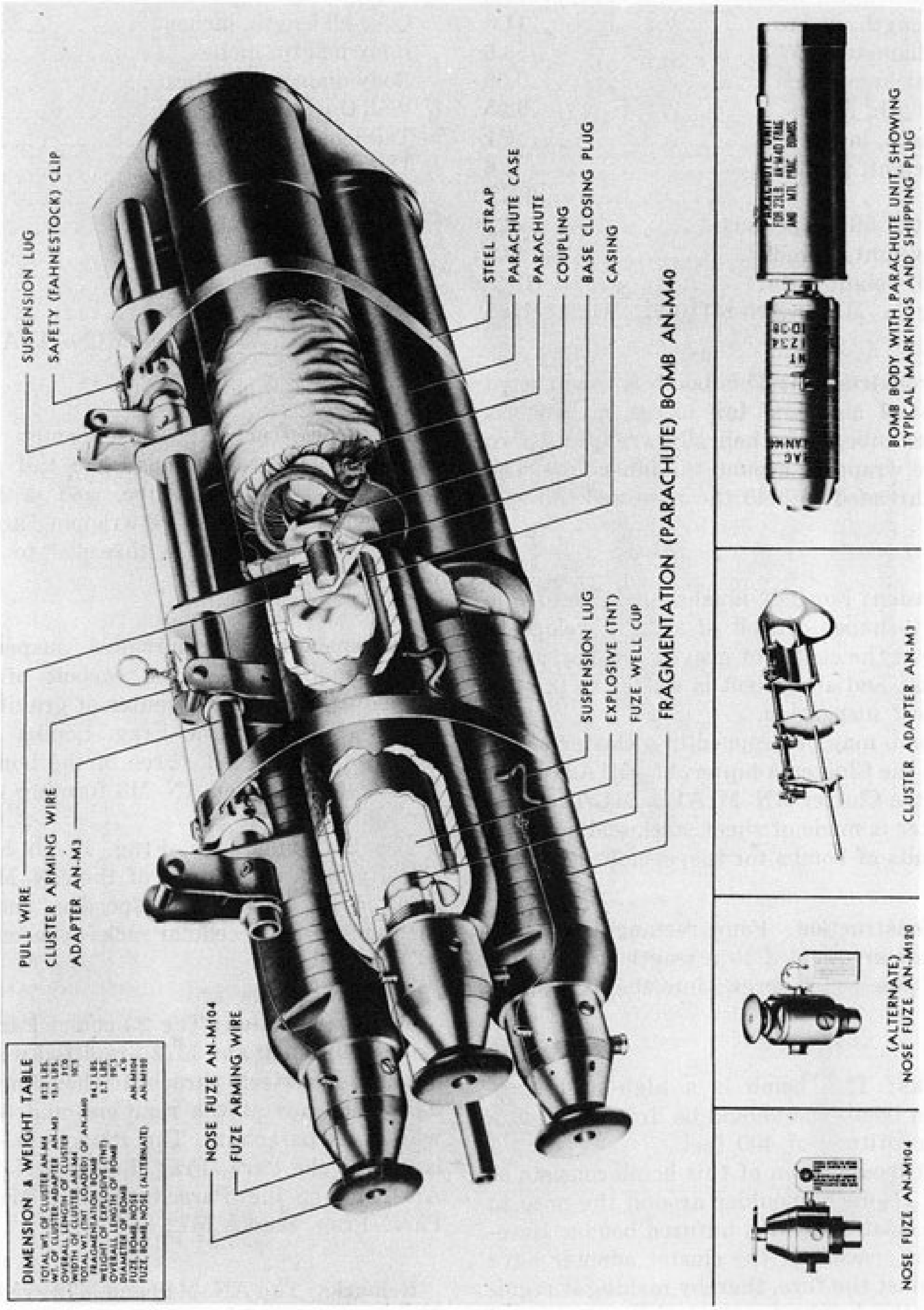


Figure 294. 23–pound Frag. Bombs in Cluster AN–M4

The A1 modification of these bombs consists of adding a 1½-inch shoulder around the nose of the bomb to facilitate clustering with unfuzed bombs. Heretofore, the spacers of the cluster adapters have fitted against the fuze, thereby making it requisite that the bombs be clustered and shipped with the fuzes inserted. Bombs with this modification are designated the 23-Pound Para.–Frag. Bombs AN–M40A1 and M72A1.

Fragmentation clusters and cluster adapters

Cluster AN–M1A1, Cluster Adapter AN–M1A2: This cluster, consisting of the Cluster Adapter AN–M1A2 or M1 and six Fragmentation Bombs AN–M41, is made of sheet metal and does not use eyebolts for suspension.

Cluster AN–M1A2, Cluster Adapter AN–M1A3: With the modification of Fragmentation Bombs AN–M41 to permit fuzing in the field, the following changes are made in the Cluster Adapter AN–M1A2: (1) flat springs are substituted for the fuze lock plates; and (2) the suspension lugs are changed from a strip type to a type similar to those on G.P. bombs. The new lugs were designed to permit suspension of the clusters in all existing types of bomb racks. The modified cluster adapter becomes the AN–M1A3, forming, with six Fragmentation Bombs AN–M41A1, the Cluster AN–M1A2.

If the modified Cluster Adapter AN–M1A3 is used with unmodified Fragmentation Bombs AN–M41; or the unmodified Cluster AN–M1A1 is used with modified Fragmentation Bombs AN–M41A1; or the unmodified Cluster Adapter AN–M1A1 is used with unmodified Fragmentation Bombs AN–M41, no change will be made in the designation of the Cluster AN–M1A1. The bombs, in these latter cases, will be fuzed when the bombs are clustered at the loading plant.

The unmodified Fragmentation Bomb AN–M41 with Cluster Adapter AN–M1A1 is not suitable for Navy use. The modified Adapter AN–M1A2 can be used, and the cluster is designated S1ZVL.

Cluster AN–M4, Cluster Adapter AN–M3: The Cluster Adapter AN–M3 and three Fragmentation Bombs AN–M40 form the Cluster AN–M4.

Cluster AN–M4A1, Cluster Adapter AN–M3: When Para.–Frag. Bombs AN–M40A1 are clustered, the Cluster Adapter AN–M3 is still used without any alteration in design, but the designation of the cluster is AN–M4A1.

Cluster M26, Cluster Adapter M13: The Fragmentation Bomb Cluster M26 consists of a Cluster Adapter M13 to which are secured twenty 20-pound Fragmentation Bombs AN–M41A1, in two groups of ten. See figure 264, page 361. The cluster is 53½ inches long, 14$\frac{11}{16}$ inches wide, and 13¾ inches high. The cluster adapter is a steel framework consisting of a tubular suspension bar to which the suspension lugs are fitted, steel separator plates, and two metal straps secured by release buckles. The separator plates located before each group of the bombs are built with arming vane stops for the Nose Fuzes M110A1 used in the individual bombs. The cluster can be adapted for either quick or delayed opening.

Quick opening is accomplished by the arming wires, which are fed through the release buckles and are withdrawn on the release of the cluster from the plane. In delayed opening, a Mechanical Time Nose Fuze M155 (T71) or M111A2 is screwed to the fuze adapter in the forward end of the tubular suspension bar. When the fuze detonates at the preset delay, the explosion drives a steel slug rearward to cut the shear wires in both the forward and the after release buckles, thereby permitting the cluster to open.

Tumbling of the Cluster M26 prevents the Nose Fuze M111A2 from arming correctly, and therefore the fuze has been modified by the substitution of an anemometer-type arming vane for the standard vane. So modified, the fuze is known as the T77. Modification can be accomplished in the field by kits now being issued.

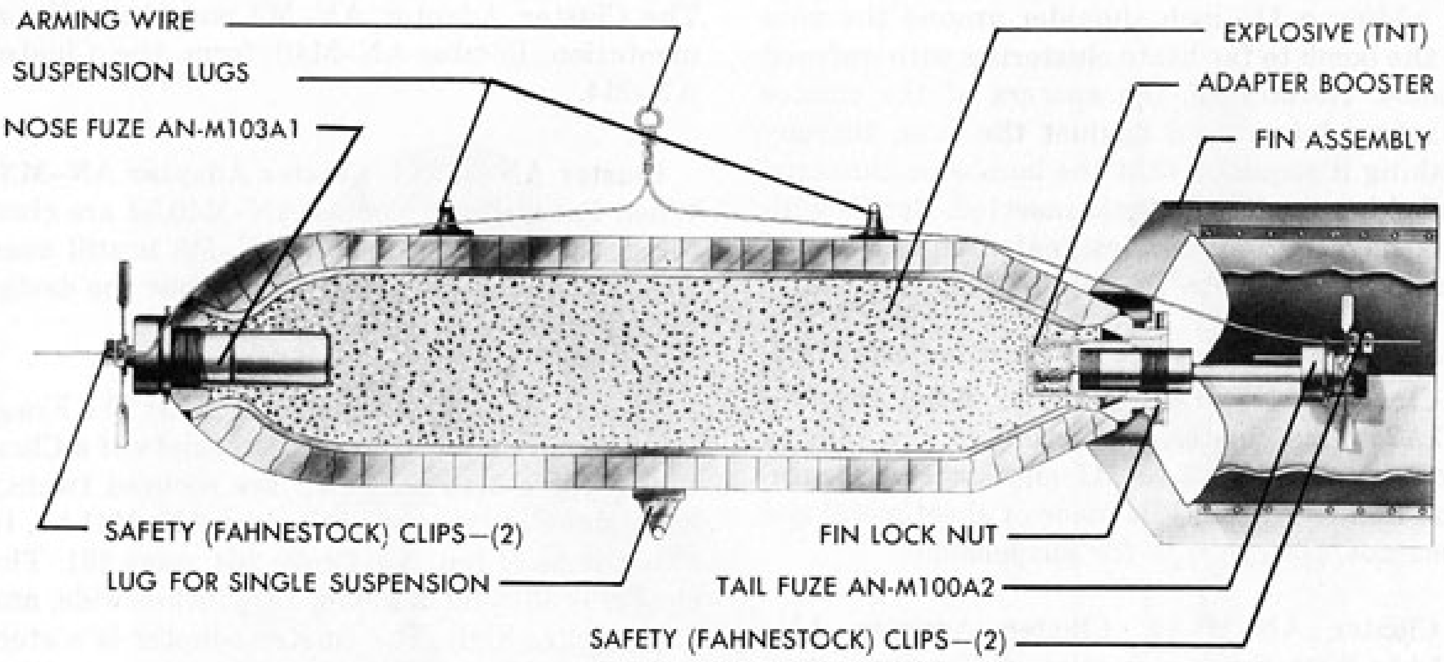


Figure 295. 260–pound Frag. Bomb AN–M81

220-, 260-pound Frag. AN–M88 (220-lb.) and AN–M81 (260-lb.)

	AN–M81	AN–M88
Over-all length	43.7″	43.7″
Body length	32.8″	32.8″
Body diameter	8″	8″
Wall thickness	1″	1.25″
Tail length	11″	11″
Tail width	11.5″	11.5″
Tail weight	4.1 lbs.	4.1 lbs.
Filling	Comp. B	Comp. B
Weight of filling	34.1#	46.69#
Total weight	260.0#	216.17#
Chg./wt. ratio	14.0%	21.6%

Fuzing

NOSE — AN - M103, AN - M103A1, M139, AN–M139A1, M140, AN–M140A1 (All instantaneous setting), M135, M135A1, M136, M136A1, M163, M164, M165, M166, T82, M149, T50E1, T89, T91.

TAIL — AN - M100A2 or AN - M100A1, M160. (A non-delay Primer Detonator M14 must be used.)

Construction: The Fragmentation Bomb AN–M88 differs from the M81 only in that it has a 0.75-inch steel coil around the body instead of the one-inch coil. Both bombs are constructed in these two ways. In initial production, nose and tail pieces are of cast-steel construction and screw onto a central section of seamless steel tubing. A square helical steel spring is wound around the steel tubing. The nose and tail pieces are partially cut through to afford greater fragmentation (this is similar to the M82, except for the provision for tail fuzes and the Auxiliary Booster M104 in the larger bombs). The majority of AN-M88's and M81's however, have a one-piece steel tubing, and the helical steel spring is wound around the steel tubing, for the entire length of the body.

Suspension is horizontal; two eyebolts are welded to body along the longitudinal axis of the bomb, 14 inches apart. A third eyebolt is welded to the body at the center of gravity 180° removed from the other eyebolts. The tail is the normal box type, secured to the bomb by a locking ring.

Remarks: The initial bombs were filled with TNT; later productions are filled with Composition B with TNT surrounds.

Present production of these bombs does not include the Auxiliary Booster M104, as this was found unnecessary.

ARMY EXPERIMENTAL TYPES

4,000-pound G.P. T8

Over-all length, inches	119
Body length, inches	85
Body diameter, inches	28
Wall thickness, inch	0.875
Explosive weight, pounds	
TNT	1,856.8
Tritonal	2,002.2
Total weight, pounds	4,030
Fuzing	
Nose	M103 series
Tail	M102 series

General: This is a design for a 4,000-pound G.P. bomb of the same general construction as others in this class.

Suspension: Standard lugs 30 inches apart.

Filling: Tritonal or TNT with a larger booster, the T21, which is like the M115 except for its increased size.

12,000-pound G.P. T10

Over-all length, feet		21
Body length, feet		10.33
Body diameter, feet		3.17
Wall thickness, inches		1.25
Tail length, feet		11
Tail width, feet		3.75
Tail weight, pounds		175
Filling	Torpex	Tritonal
Weight of filling	4,980#	5,500#
Total weight (w/o tail)	11,630#	12,448#
Chg./wt. Ratio	42%	44%

Fuzing: British Tail Pistol No. 58 Mk I is used at present, but these will eventually be replaced with the Air-Arming Fuzes T723, placed 120° apart in the base plate. The fuze delays which were used operationally with this bomb in the war were 0.05-second, 0.25-second, 0.5-second, 3-seconds, 11-seconds, 24 to 30 minutes, and one hour.

Body construction: The body is manufactured in two different ways. The British-produced model is of cast steel, with a solid nose plug and with three exploders fitted 120° apart in the tail. The bomb bodies are issued with exploders inserted, and the exploder tubes are sealed with shipping plugs. The eventual American T10 will consist of five sections welded together. These sections are a solid nose forging, two body forgings, a rolled plate body section, and a base ring forging. The base plate, which is a forging, is held to the base ring by means of 20 studs.

The tail is attached to the after end of the bomb body by 12 studs. A cylindrical metal cowling, placed between the bomb body and the tail cone, enhances the streamlining of the bomb.

Tail construction: The special Tail Unit, No. 78 Mk I is constructed of light alloy and consists of a cone to which are attached four fins of streamline cross-section. The fins are set at an angle of 5° to the axis of the tail cone, giving a slight right-hand spin to the bomb as it falls. The tail fits over twelve $\frac{7}{16}$-inch studs fitted into the bomb body, and is securely fastened to the studs by Simmonds nuts. Three hand-holes in the tail cone give ready access to the three tail pistols, and an additional hole is provided for arming wires.

Suspension: The bomb is suspended in the plane by twin suspension slings.

Filling: The bomb body contains an explosive filling of Torpex with a one-inch layer of TNT topping added to the after end. Four inches of

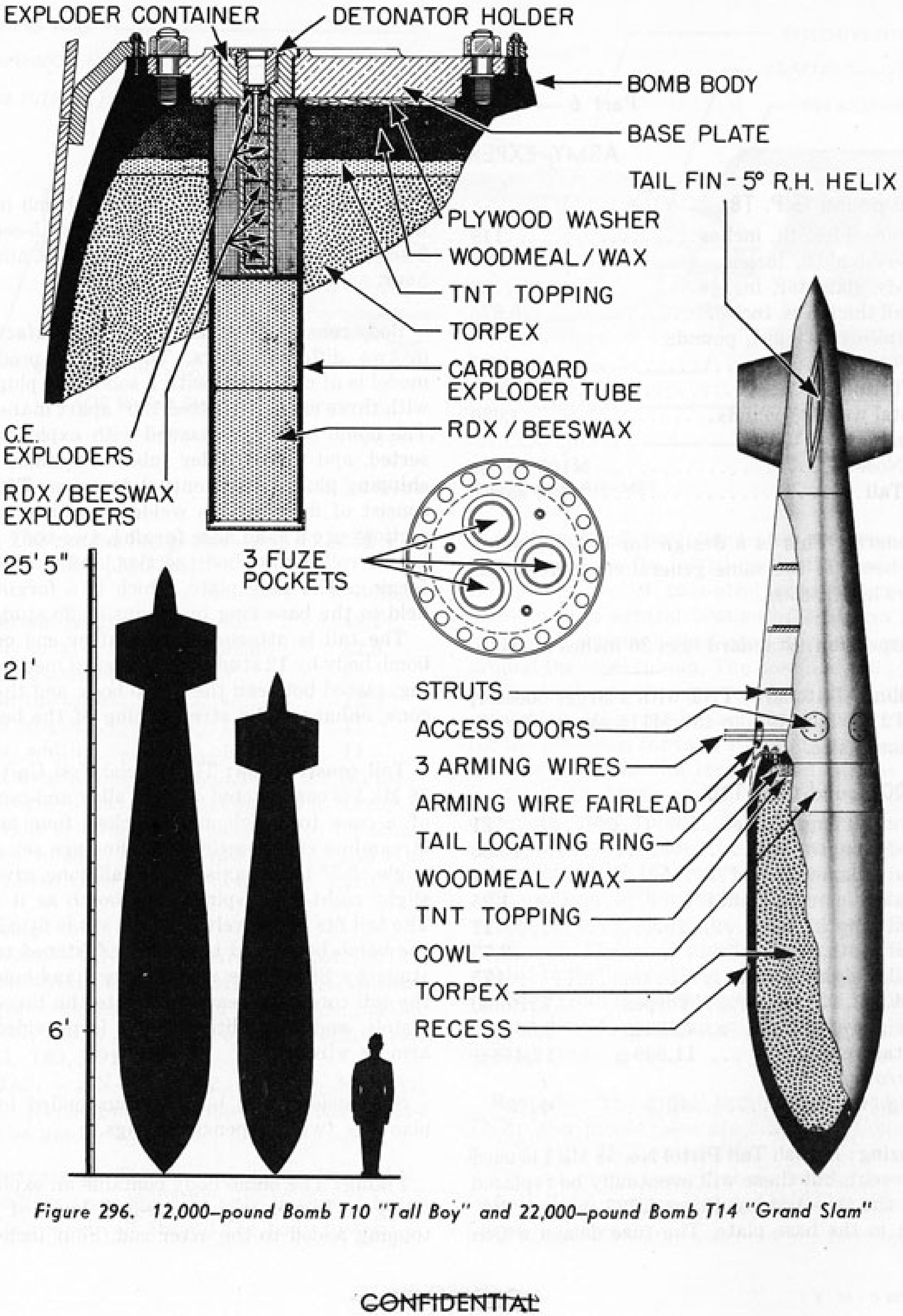


Figure 296. 12,000–pound Bomb T10 "Tall Boy" and 22,000–pound Bomb T14 "Grand Slam"

woodmeal/wax composition is then added, and the filling sealed with a ½-inch plyboard washer. The three exploders pass through holes in this washer and are held in place by a heavy base plate, which is secured by bolts to the bomb body.

The American bomb will be filled with Tritonal, with an inert tail surround.

Remarks: This bomb is designed for limited operational use, and its employment will be restricted to specially adapted very heavy bombers. Although designated a G.P. bomb, the T10 is essentially a deep-penetration bomb (though not armor- or concrete-piercing) depending for its effect upon the production of heavy shock waves as a result of the explosion of its main charge deep within the earth.

The T10 is the American designation for the British 12,000-pound D.P. (Deep-Penetration) "Tallboy" bomb. Except for size and fuze pocket arrangement, it is similar to the 22,000-pound G.P. Bomb T14.

22,00-pound G.P. T14

Over-all length, feet	25.41	
Body length, feet	12.50	
Body diameter, feet	3.83	
Wall thickness, inches	1.75	
Tail length, feet	13.33	
Tail width, feet	4.48	
Tail weight, pounds	287	
Filling	Torpex	Tritonal
Weight of filling	9,200#	9,605#
Total weight (w/o tail)	21,875#	22,155#
Chg./wt. ratio	42%	43%

Fuzing: Three British Tail Pistols No. 58 Mk I are used at present, but these will eventually be replaced with the Air-Arming Fuzes T723, placed in a straight line across the base plate.

Body construction: The body is manufactured in two different ways. The British-produced model is of cast steel, with a solid nose plug and with three exploders fitted 120° apart in the tail. The bomb bodies are issued with exploders inserted, and the exploder tubes are sealed with shipping plugs. The eventual American T14 will consist of five sections welded together. These sections are a solid nose forging, two body forgings, a rolled plate body section, and a base ring forging. The base plate, which is a forging, is held to the base ring by means of 20 studs.

The tail is attached to the after end of the bomb body by 12 studs. A cylindrical cowling, placed between the bomb body and the tail cone, enhances the streamlining of the bomb.

Tail construction: The special Tail Unit No. 82 Mk I is constructed of light alloy and consists of a cone to which are attached four fins of streamline cross-section. The fins are set at an angle of 5° to the axis of the tail cone, giving a right-hand spin to the bomb as it falls. The tail fits over twelve $\frac{7}{16}$-inch studs fitted into the bomb body, and is securely fastened to the studs by Simmonds nuts. Three hand-holes in the tail cone give ready access to the three tail pistols, and an additional hole is provided for arming wires.

Suspension: The bomb is suspended in the plane by twin suspension slings.

Filling: The bomb contains an explosive filling of Torpex with a one-inch layer of TNT topping added to the after end. Four inches of woodmeal/wax composition is then added, and the filling sealed with a ½-inch plyboard washer. The three exploders pass through holes in this washer and are held in place by a heavy base plate, which is secured by bolts to the bomb body. The American bomb will be filled with Tritonal, with an inert tail surround.

Remarks: This bomb is designed for limited operational use, and its employment will be restricted to specially adapted very heavy bombers. Although designated a G.P. bomb, the T14 is essentialy a deep-penetration bomb (though not armor- or concrete-piercing) depending for its effect upon the production of heavy shock waves as a result of the explosion of its main charge deep within the earth.

The general arrangement of this bomb is identical to that of the 12,000-pound Bomb T40. The

two bombs are identical, except that the T14 has three in-line fuze pockets instead of pockets placed 120° apart as in the T10, and the T14 is an enlarged version of the T10.

The T14 is American designation for the British 22,000-pound D.P. "Grand Slam" bomb.

CHEMICAL, INCENDIARY, AND SMOKE BOMBS

Section 1 — INTRODUCTION

Chemical

In general, the chemical bombs are of two types, classified according to case construction. The light-case bombs have the advantage of higher charge/weight ratio, whereas the heavy-case bombs have better stowage and handling characteristics. Both types have full-length burster charges to split the bomb case and disperse the filling over the area to be contaminated. Fuzing must always be instantaneous or aerial burst to maintain maximum dispersion of contents. Various fillings can be employed for different effects.

Incendiaries

Incendiaries in use at the present time are classified by their construction and use into two types. The intensive type burns as a unit, confining its intense heat to a relatively small area. The bombs are small in size and are always dropped in clusters to give area coverage. They are normally employed against targets having a high percentage of roof coverage, such as industrial establishments and crowded residential areas. Since the bombs have heavy nose plugs and substantial case strength, some penetration can be expected, and the high burning temperature of the filling will be effective in industrial areas.

The scatter type is usually a larger bomb which disperses small chunks of its burning material over a large area to ignite many small fires. It is normally employed against readily inflammable targets such as frame construction, material storage, and grain fields. These bombs explode on impact, to throw burning fragments of gasoline gel or other sticky emulsions against the target.

Screening smokes

Only the screening smokes will be considered in this chapter, signalling and illuminating smokes being treated under Pyrotechnics. This division follows in large part the allocation of responsibility for smoke munitions made between the Chemical Warfare Service and the Ordnance Department of the Army. C.W.S. supervises matters relating to screening smokes, and the Ordnance Department performs the same functions for signalling and illuminating items.

Color and markings

Chemical bombs have different markings from other types of ordnance. The bomb body is painted light grey, and colored bands indicate the nature of the filling. The bands are located between the dual suspension lugs and before the center of gravity. One band indicates a non-persistent filler. Two bands indicate a persistent filler. Green indicates casualty agents; red, harassing agents; yellow, smoke or screening agents; purple, incendiaries.

Incendiary bombs may follow the scheme of chemical bombs, with light grey body color and a purple band. More recently, an olive drab body color with a purple band has been standardized.

All these items represent a different type of hazard from high-explosive-filled bombs. They are particularly susceptible to fire, and proper precautions should be observed. In handling several of the pyrotechnics and incendiaries, remember to avoid friction such as would be caused by rolling or dragging the missile.

Suspension

Heavy-case chemical bombs are suspended in

the same manner as G.P. bombs; that is, by dual lugs or by a single lug welded to the bomb case. The light-case chemical bombs are suspended by lugs welded to bands which fit around the bomb body. Incendiary bombs of the large scatter type have the same suspension as the chemical bombs. The smaller incendiary bombs are always clustered, and for maximum packing efficiency are hexagonal in shape. The clusters employed on incendiaries are of two types, the quick-opening variety and the aimable type with a cluster opening controlled by an aerial burst fuze. The quick-opening clusters come in two sizes—100-pound and 500-pound. The cluster adapters for 4-pound intensive incendiaries will carry 34 bombs in the 100-pound size or 128 bombs in the 500-pound size. The adapters for 6-pound scatter incendiaries carry 14 bombs or 60 bombs. The cluster adapters consist of steel tubes supported by plates, with the bombs assembled around the tubes. The bombs are held in place by spring-steel bands secured by an arming wire running through a buckle at the end of the band. Removal of the arming wire assembly as the cluster drops releases the buckles, and the bands open to release the bombs immediately.

The aimable clusters are relatively new. They fit a 500-pound bomb station and are designed for precision bombing from high altitudes. To give the cluster the desired ballistic properties, a standard box-type tail assembly is attached by a single bolt to the after plate of the cluster adapter. A strip of primacord (PETN) running full-length along the side of the cluster serves to break the spring steel bands and allow the bombs to scatter when the aerial-burst nose fuze functions. The 500-pound Aimable Cluster AN–M17A1 is filled with 110 4-pound Incendiary Bombs AN–M50A2 and AN–M50XA3. The Cluster Adapter E6R2 (500-pound) contains Incendiary Bombs AN–M69 or M74. The Aimable Cluster Adapter M23 (500-pound) contains 38 bombs, either Incendiary Bomb AN–M69, Incendiary Bomb M74, or Smoke Bomb M77.

Jettisonable fuel tanks—"Fire bombs"

Fuel tanks filled with a gasoline-Napalm mixture for incendiary purposes and fitted with igniters were developed during the war. At present, however, this practice has been discontinued.

Clusters, cluster adapters

Because of the number and variety of clusters for this type of ordnance, the clusters are described with the appropriate bomb instead of separately.

Part 6 — Chapter 18 — Section 2

"M" SERIES

10-pound Incendiary M74

Overall length, inches	19.4
Body length, inches	19.4
Body diameter, inches	3.0
Tail length, inches	6.3
Tail width, inches	2.5
Filling	PT 1 or NP
Fuzing	M142, M142A1, M3

Construction: This bomb has the same type of construction as the 6-pound Oil Incendiary Bomb AN–M69, with a sheet-steel leak-proof casing and a nose cup housing the fuze. A small chemical container, located immediately behind the dome of the nose cup, is filled with white phosphorus, to aid ignition of the incendiary composition and produce smoke. In bombs with NP, the filling is enclosed in a cheesecloth sock; if PT 1 is used, it is loaded directly into the bomb. The Incendiary Bomb M74 has a telescope-type tail which fits inside the tail cup and is ejected under spring pressure when the bomb is released from the cluster. A well inside the tail cup holds the tail sleeve when the assembly is compressed in the cup.

Suspension

Cluster	Adapter	Size	Bombs
E29	E6R2	500# Aimable	38 M74
E48	M23	500# Aimable	38 M74
E61	M23	500# Aimable	38 E5R8

Operation: The striker of the Fuze M142 or M142A1 ignites the primer, which sets off the booster and main ejection charge. This activates the auxiliary ejection-ignition charge. Expanding gases rupture the dome-shaped ejection diaphragm, which forces the WP-filled cup, incendiary filling, tail cup, and tail assembly out of the bomb casing.

Remarks: Do not reinsert arming pin after it has been ejected, as it may cause the fuze to function.

The experimental bombs of this type with other fillings are designated the E5 series. The experimental bomb with a white phosphorus filling has been rejected; however, the one with the mustard filling, E5R8, is still under development. This bomb will be carried in the Cluster E61 holding 38 bombs (Cluster Adapter M23).

Cluster Adapter E6R2

Over-all length, inches................59.06
Body diameter, inches..................14.69
Tail width, inches..................16 to 18
Fuzing....................M138, AN–M145

General: The cluster adapter has a thin steel body that is shaped like a bomb, except the nose is not rounded off to make a full hemisphere. A standard-type bomb fin is affixed to the rear of the adapter, and a fuze fits in the nose. Hoisting and suspension lugs are located at the top. Internally, the adapter is equipped with cluster bars for positioning of the bombs when loaded. An L-shaped angle bar runs the entire length of the adapter along the bottom cluster bar. Into the angle bar is fitted a light steel tube which encloses a length of primacord that extends from the nose fuze to the other end of the cluster adapter. When the cluster is filled, the bombs

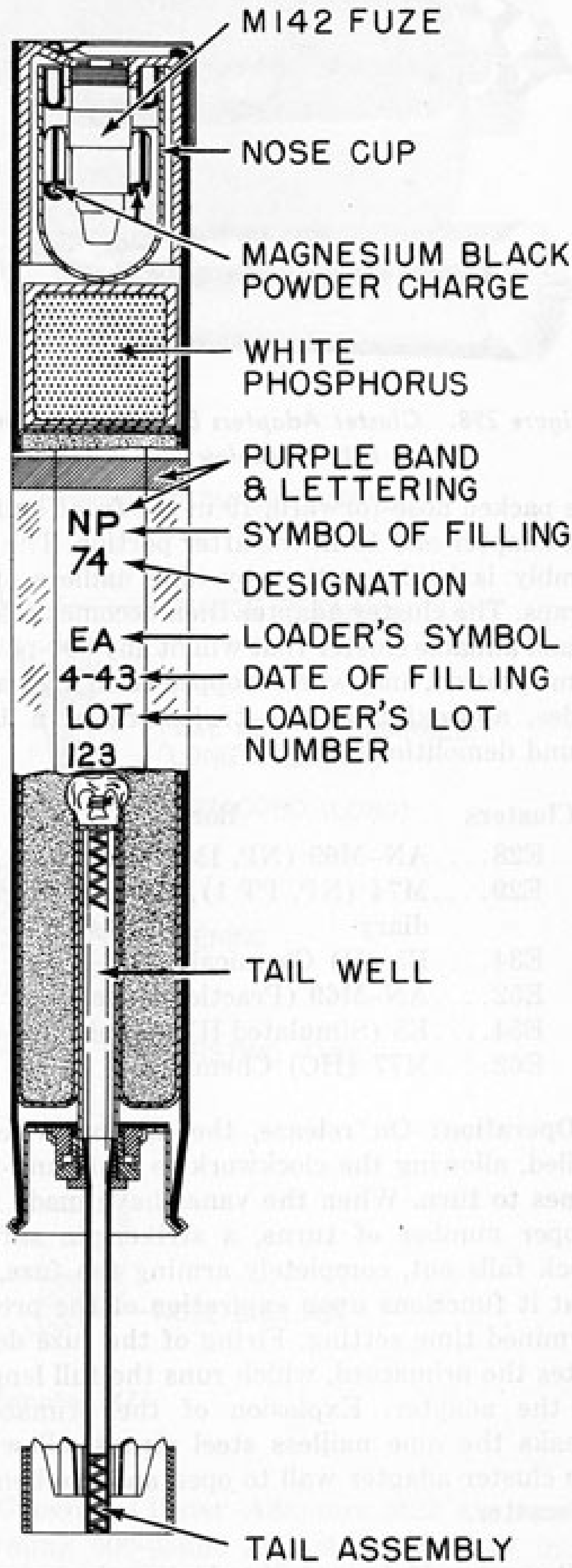


Figure 297. 10-pound Incendiary Bomb M74

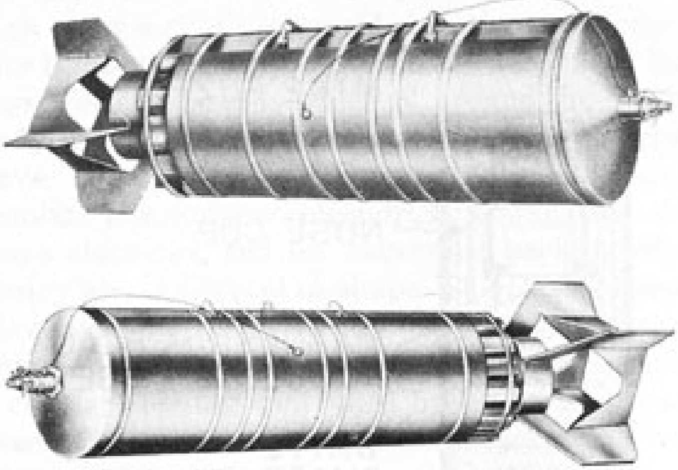


Figure 298. Cluster Adapters E6R2 (above) and M10A1 (below)

are packed nose-forward, 19 in the front half of the adapter and 19 in the after portion. The assembly is held together by nine nailless steel straps. The cluster adapter then becomes a 500-pound aimable cluster that will fit any 500-pound bomb station, and, when dropped from high altitudes, approximates the trajectory of a 100-pound demolition bomb.

Clusters	Bombs
E28	AN–M69 (NP, IM) Incendiary
E29	M74 (NP, PT 1), E5 (IM), Incendiary
E34	E5 (H) Chemical
E52	AN–M69 (Practice) Incendiary
E54	E5 (Simulated H) Chemical
E62	M77 (HC) Chemical

Operation: On release, the arming wire is pulled, allowing the clockwork to start and the vanes to turn. When the vanes have made the proper number of turns, a striker-pin safety block falls out, completely arming the fuze, so that it functions upon expiration of the predetermined time setting. Firing of the fuze detonates the primacord, which runs the full length of the adapter. Explosion of the primacord breaks the nine nailless steel straps, allowing the cluster adapter wall to open and the bombs to scatter.

Remarks: If desired, the cluster adapter may be kept intact during the entire period of flight, bursting open on impact.

This adapter is being replaced by the Cluster Adapter M23.

Cluster Adapter M10A1

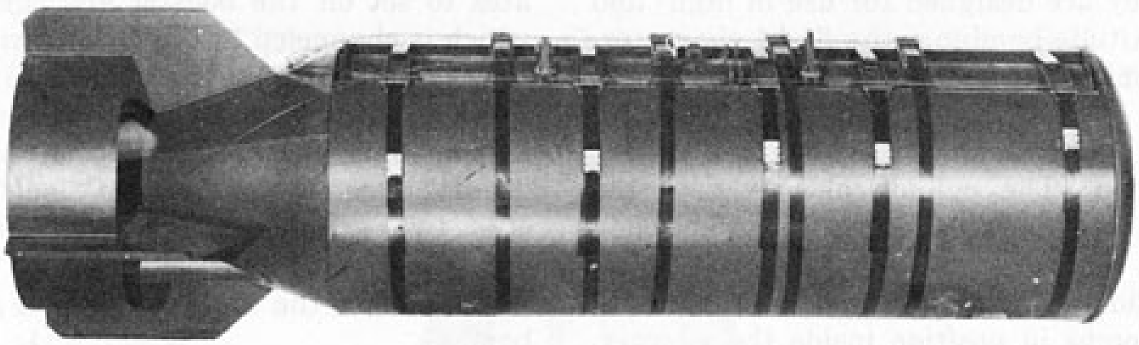
Over-all length, inches	56.0
Diameter, inches	15.3
Fuzing	AN–M128

General: The cluster adapter is streamlined in shape, and, when filled, it becomes a 500-pound aimable cluster designed to be carried by any plane equipped to carry a 500-pound bomb. Clusters formed with this adapter are the AN–M14, which contains 104 Incendiary Bombs AN–M50TA2, four AN–M50XA3 Type A, and two AN–M50XA3 Type B; and the AN–M17A1, which contains 88 Incendiary Bombs AN–M50A2, 16 AN–M50XA3 Type A, and six AN–M50XA3 Type B.

The cluster adapter consists of a thin metal case with a channel bar extending through the center, and a standard tail fin fixed to the after end plate by means of a single heavy bolt. At the forward end, a rounded nose fairing is fastened to the forward end plate. From the fuze seat, a length of primacord extends through a thin metal tube to the after end of the adapter. The adapter is equipped with three suspension lugs, the center lug added for use in British planes. When the cluster adapter is loaded, the bombs are packed around the channel bar and the assembly is held in place by nine metal straps.

Operation: On release, the arming wire is pulled, allowing the fuze to arm and fire at the pre-set time. When the fuze fires, the primacord is detonated, breaking the metal straps holding the assembly together and allowing the bombs to fall free.

Remarks: The Cluster Adapter M10A1 is similar in appearance to the E6R2, but differs internally. The bombs in the M10A1 are packed around a channel bar, while in the E6R2 the cluster bars surrounding the bombs hold them in place.



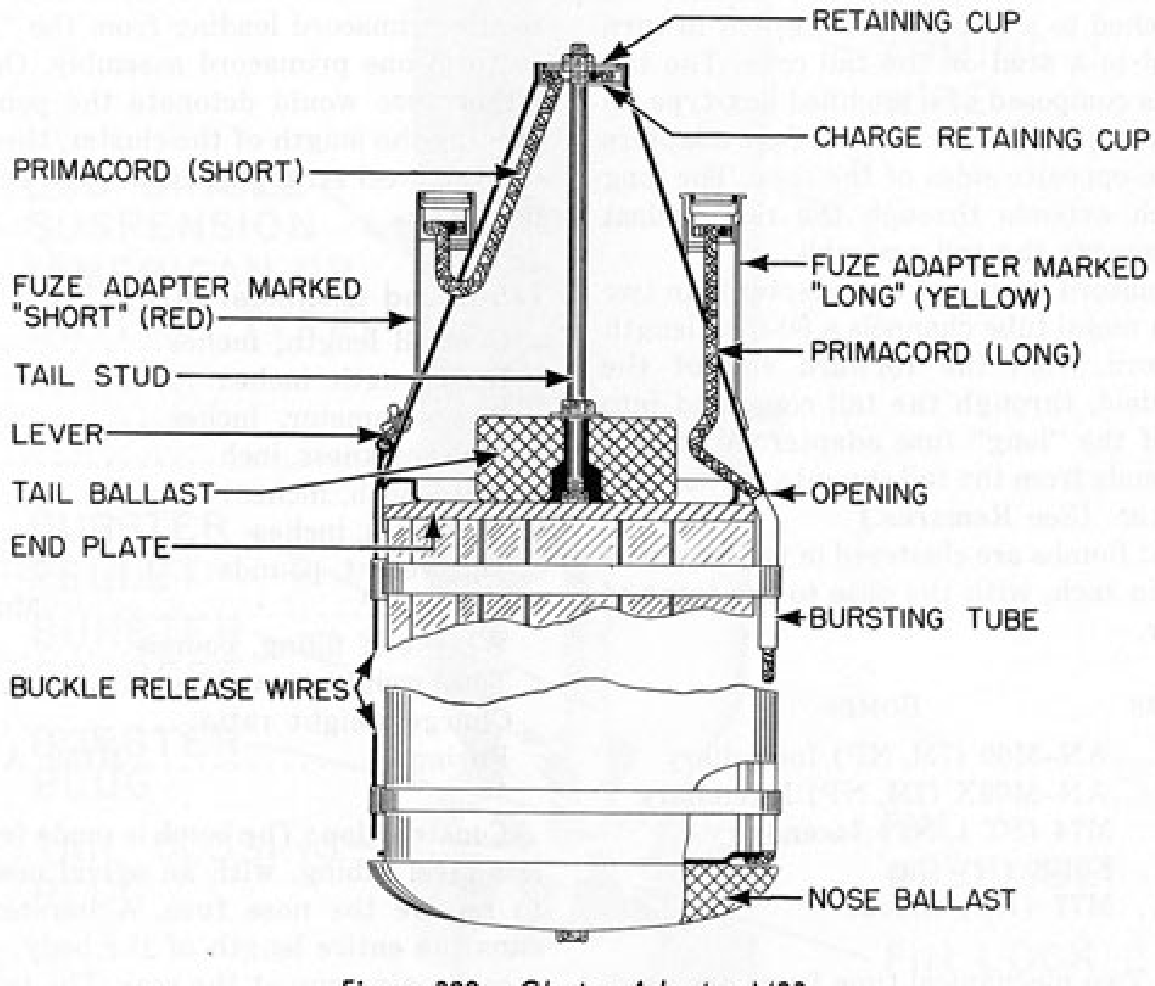


Figure 299. Cluster Adapter M23

Cluster Adapter M23

Over-all length, inches	59.5
Body diameter, inches	14.75
Tail width, inches	19.0

General: Cluster Adapters M23 are used in forming 500-pound aimable clusters of incendiary or chemical bombs. Clusters may be carried by planes equipped to handle 500-pound

bombs. They are designed for use in high- and medium-altitude bombing, the flight characteristics resembling those of the Practice Bomb M38A2.

Description: The cylindrical halves of the cluster wall are joined at the top by a suspension bar and at the bottom by a burster-shield support bar. Cluster bars, fitted into the end plates, hold the bombs in position inside the adapter. Ballast weights are bolted by studs to the front and rear of the adapter's end plates. Nine steel straps, drawn tight and fastened by a metal connector, are attached to release buckles which are placed on alternate sides of the suspension bar. The buckles are held closed by two release wires attached to a release lever, which in turn is attached to a stud on the tail cone. The tail assembly is composed of a modified box-type fin on a conical support, with two tail-fuze adapters attached to opposite sides of the cone. The long stud, which extends through the rear ballast weight, supports the tail assembly.

The primacord wiring of the adapter is in two sections. A metal tube channels a 60-inch length of primacord from the forward end of the burster shield, through the tail cone, and into the base of the "long" fuze adapter. A 31-inch length extends from the tail cup into the "short" fuze adapter. (See **Remarks.**)

Clusters: Bombs are clustered in two sections, 19 bombs in each, with the nose to the front of the cluster.

CLUSTERS	BOMBS
M19	AN–M69 (IM, NP) Incendiary
M21	AN–M69X (IM, NP) Incendiary
E48	M74 (PT 1, NP) Incendiary
E61	E5R8 (H) Gas
E67	M77 (HC) Smoke

Fuzing: Two mechanical time fuzes are used, one being placed in the "long" and one in the "short" fuze adapters. Two Fuzes M153 are now used, but are being replaced by two Fuzes M152.

Operation: On release, the arming wires are withdrawn and the two fuzes arm. Upon expiration of the time setting, the "short" fuze operates to set off the booster and the primacord, which is channeled to the fin-retaining cup. The cone is blown off by the primacord detonation, thereby withdrawing the buckle release wires and opening the cluster. Upon failure of the "short" fuze to function, the "long" fuze operates two seconds later. This detonates the primacord extending the length of the cluster, which shears the steel straps and releases the bombs.

Remarks: Some lots of adapters were shipped without buckles and release wires, the release of the bombs being dependent on the severing of the steel strapping bands. The primacord from the "short" fuze is taped at a right angle to the primacord leading from the "long" fuze, to form one primacord assembly. Operation of either fuze would detonate the primacord extending the length of the cluster, thereby severing the steel strapping bands and releasing the bombs.

115-pound Chemical M70

Over-all length, inches	48.7
Body length, inches	40.4
Body diameter, inches	8.1
Wall thickness, inch	0.224
Tail length, inches	12.9
Tail width, inches	10.9
Tail weight, pounds	3.5
Filling	Mustard (H)
Weight of filling, pounds	57.1
Total weight, pounds	122.5
Charge/weight ratio	46.6%
Fuzing	M159, AN–M110A1

Construction: The bomb is made from a seamless steel tubing, with an ogival nose threaded to receive the nose fuze. A burster-well tube runs the entire length of the body, fitting into a positioning cup at the rear. The tail assembly consists of four fins welded to a sleeve, which is secured by a locking nut threading into the tail closing block. The fins are supported by box-type struts.

Suspension: The bomb is carried horizontally by dual lugs seven inches on either side of the

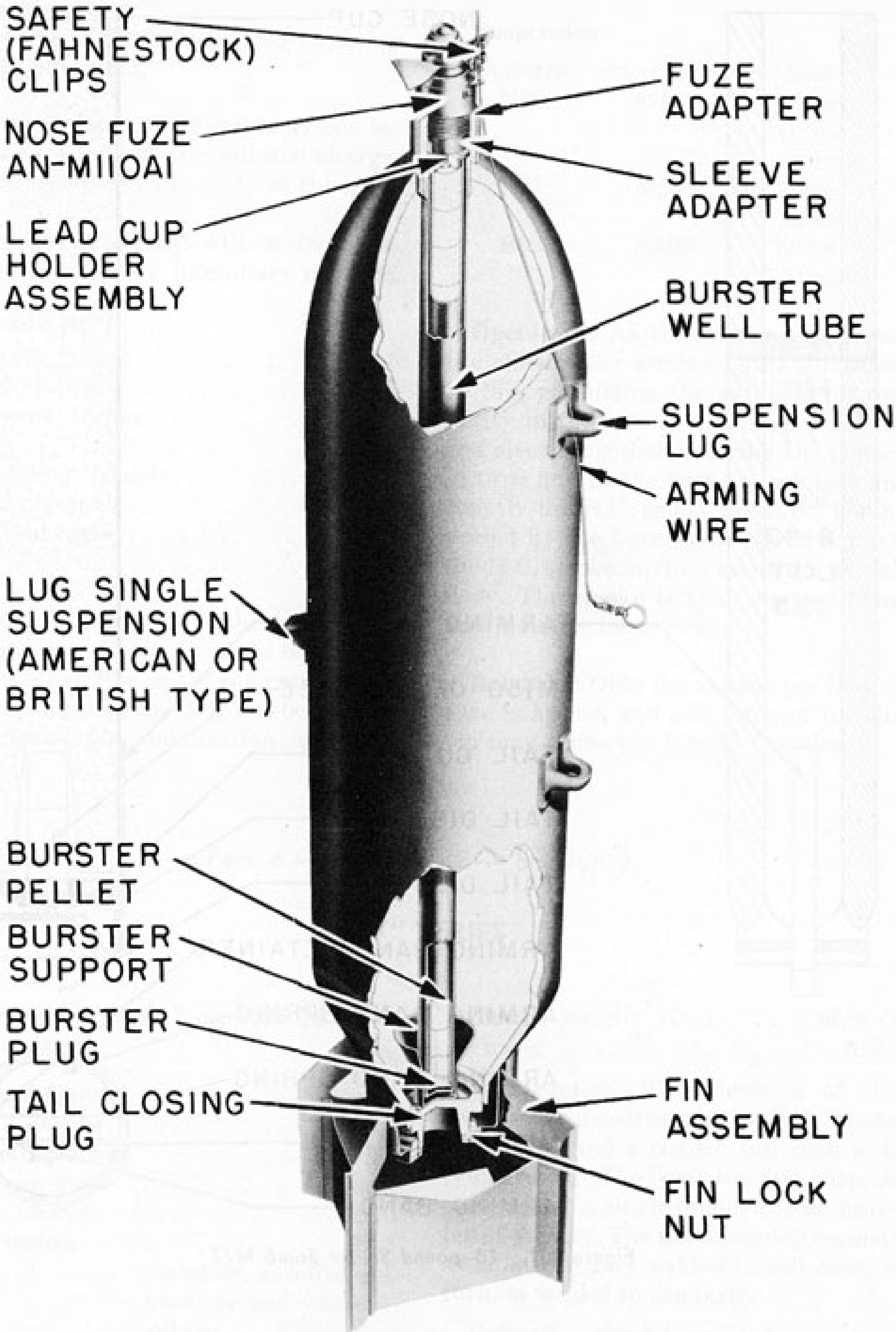


Figure 300. 115–pound Chemical Bomb M70

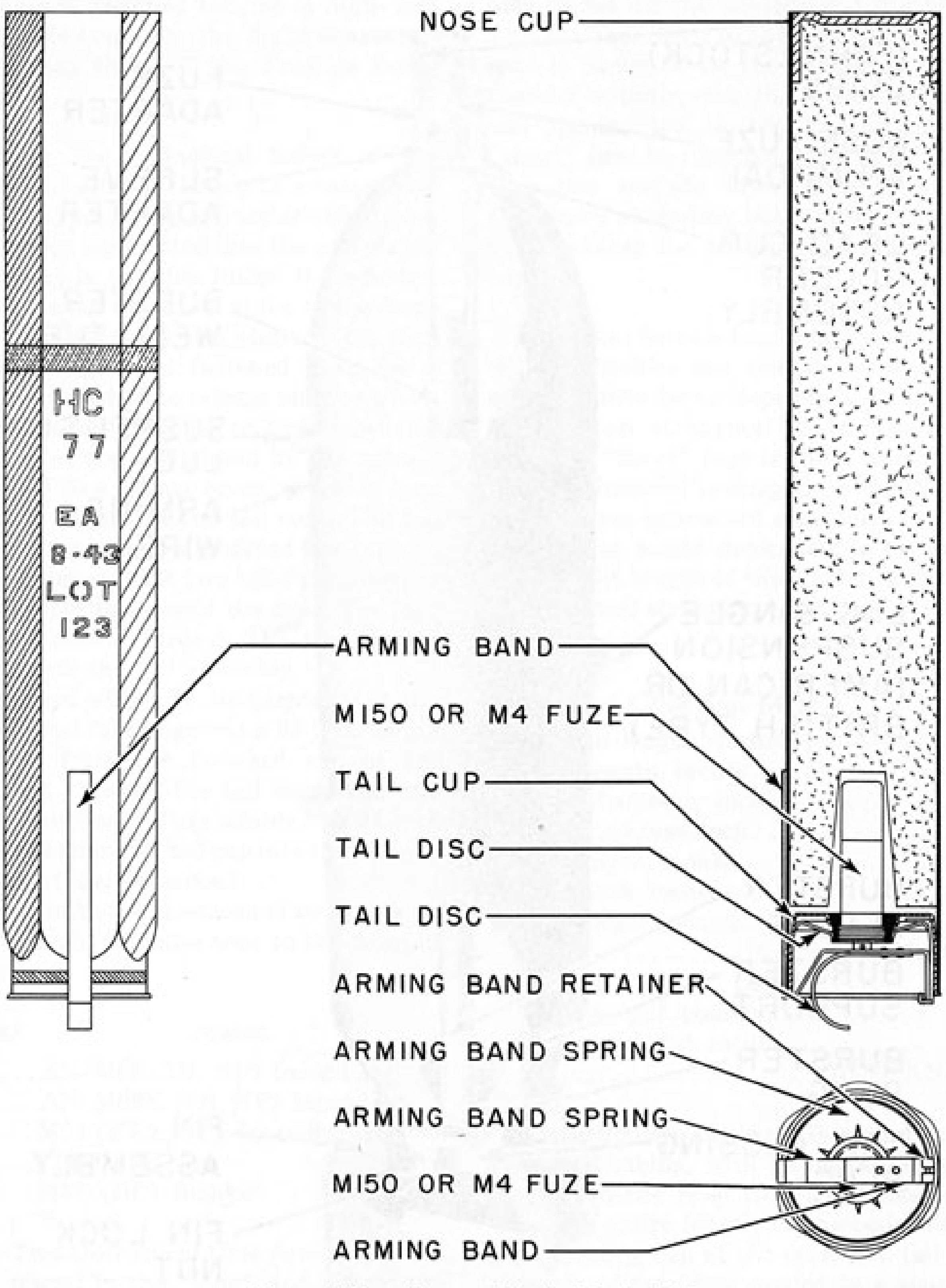


Figure 301. 10–pound Smoke Bomb M77

center of gravity, or a single lug 180° removed at the center of gravity.

A cluster of four M70's is formed by using the Cluster Adapter M22.

Remarks: On impact, the fuze functions instantaneously, setting off the burster charge, which explodes the bomb and scatters the main filling.

The M70 can also be filled with white phosphorus, or with IM or NP incendiary mixture.

10-pound Smoke M77

Over-all length, inches	19.5
Body length, inches	19.5
Body diameter, inches	2.9
Filling	HC
Weight of filling, pounds	9.5
Total weight, pounds	13
Charge/weight ratio	73%
Fuzing	M150

Construction: The body is a sheet-steel casing extending the entire length of the bomb. The tail cup fits into the after end of the casing, having a dome housing the Fuze M4. The bomb does not have a device for stabilization in flight; therefore, an all-ways fuze is employed.

Suspension

CLUSTER	ADAPTER	SIZE	BOMBS
M25	M4	100# Quick opening	14 M77
E67	M23	500# Aimable	38 M77
E62	E6R2	500# Aimable	38 M77

Operation: As the bombs are released from the cluster, the arming pin is forced out by its spring, permitting the safety pin to enter the cavity in the striker. Impact forces the striker and sleeve together, piercing the primer, which in turn ignites the first fire mixture and subsequently the H.C. smoke mixture. The heat generated by the burning of the first mixture and the H.C. smoke mixture melts the zinc-alloy fuze body. The smoke is then emitted through the fuze hole in the tail cup.

Remarks: Once the arming pin jumps out, the fuze is armed, and any attempt to reinsert the pin may cause the fuze to function.

Part 6 — Chapter 18 — Section 3

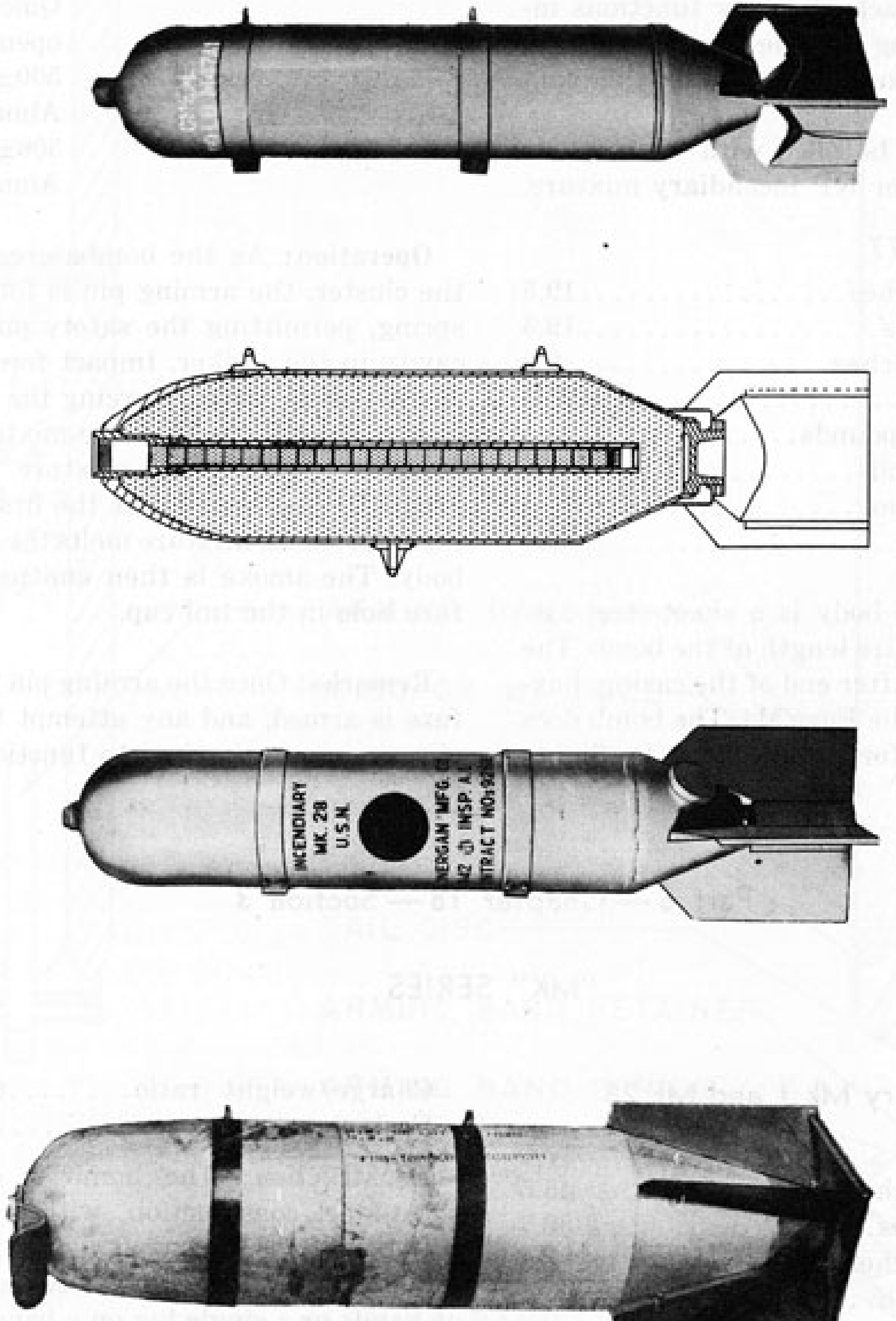
"MK" SERIES

100-pound Incendiary Mk 1 and Mk 28 (Obsolete)

Over-all length, inches	45.5
Body length, inches	33.7
Body diameter, inches	8.0
Wall thickness, inch	0.05
Tail length, inches	11.75
Tail width, inches	11.3
Filling	Gasoline, gasoline-gel, gasoline and waste, rubber
Weight of filling, pounds	42 to 45
Total weight, pounds	65 to 68
Charge/weight ratio	65% (approx.)
Fuzing	AN–M126A1

Construction: The bomb is of three-piece sheet-steel construction, with a hemispherical nose piece and a conical tail cone welded to a tubular body. The bomb has two suspension lugs on bands or a single lug on a band near the center of gravity. The tail assembly consists of four sheet-steel vanes welded to tail cone, which, in turn, is welded to the body.

Color: The bomb is painted grey over all, with a bright red disc, four inches in diameter, in the middle of the body.



MK47A1
CHEMICAL

MK42
CHEMICAL

MK 28
INCENDIARY

MK 3
SMOKE

Figure 302. Navy 100–pound Smoke, Incendiary, and Chemical Bombs

Remarks: This bomb is similar to the 100-pound Incendiary Bomb AN-M47A2, except that it is equipped with a filler cap. Both bombs are prone to leak and should be examined frequently.

There is also a 100-pound Incendiary Bomb Mk I, which is almost identical to the old Army M47, both of which are obsolete.

100-pound Chemical Mk 42

Over-all length, inches	39.43
Body length, inches	27.70
Body diameter, inches	8.0
Wall thickness, inch	0.17
Tail length, inches	9.46
Tail width, inches	11.0
Filling	Mustard
Weight of filling, pounds	43
Total weight, pounds	86.5
Charge/weight ratio	50%
Fuzing	AN–Mk 219

Construction: The steel tube is swaged aft. An adapter screws into the nose and is threaded to receive the fuze. A burster tube containing TNT, running the length of the bomb, screws into the after end of the adapter. The after end of the body is closed by a male base plate, which is threaded for the tail assembly to be fitted. The bomb is filled through the nose. Suspension is by two lugs seven inches on either side of the center of gravity or a single lug 180° removed and at the center of gravity. The bomb has a box-type, four-fin tail, secured by a locking nut.

Markings: The bomb is painted olive drab over all, with two green bands ½ inch wide and ½ inch apart abaft the nose.

50-, 100-pound Floating Smoke (Obsolescent) Mk 3 Mod 0 (100-lb.), Mk 1 Mod 1 (50-lb.), Mk 1 Mod 2 (50-lb.)

	Mk 3 Mod 0	Mk 1 Mod 2
Over-all length	48.5″	38.29″
Body diameter	10.25″	8.85″
Tail length	13″	9.40″
Tail width	14.25″	8.94″
Filling	HC mixture	HC mixture
Weight of filling	59#	28#
Total weight	102#	54#
Chg./wt. ratio	57.8%	51.8%
Fuzing	Mk 3 Mod 1	Mk 3 Mod 1

Construction: An aluminum nose casting, carrying a pyrotechnic charge, is attached to a hollow wood float which provides buoyancy. The nose carries a water-impact fuze, and at the tail of the float is a valve cap with the valve to prevent water from leaking into the interior of the bomb. The rear of the bomb is conical in shape, and the aluminum nose is hemispherical. The tail consists of four fins bolted to the rear of the bomb, with four tubular struts bolted to the fins. The fins do not extend upon the rear end of the bomb.

Suspension: Two movable suspension bands are used on the Floating Smoke Bomb Mk 3 Mod 0; the Mk 1 Mods 1 and 2 may have either one or two suspension bands. The latest issue has one band and one attached lug, so that the bombs may be suspended from the single- and double-hook racks.

Action: Impact operates the firing mechanism in the nose, detonating the primer, which in turn ignites a length of time fuse giving a delay of 18 seconds, during which time the smoke bomb is returning to and becoming stable on the surface of the water. The time fuse ignites the quick match which, in turn, ignites the starting mixture and this initiates the action of the smoke mixture. Gas pressure formed by the burning smoke mixture breaks the vent discs and opens the valve cap at the tail end of the wooden float. The bomb then evolves a dense white smoke for about 7.5 minutes in the Mk 3 Mod 0; 2.5 to 5 minutes in the Mk 1 Mod 1 and 5 to 7.5 minutes in the Mk 1 Mod 2

Remarks: This bomb should be dropped from an altitude of over 500 feet and should not be dropped in less than 40 feet of water where the bottom is soft enough to cause the bomb to stick

and fail to return to the surface. While designed for use over water, the bomb may also be effective if dropped over ordinary loam soil, if dropped from an altitude under 2,000 feet. If dropped from over 2,000 feet or if dropped from any altitude onto very hard rocky ground, the bomb will usually deflagrate. The HC mixture is a pressed powder, safe under any normal storage or handling conditions. The smoke, while harmless in the concentrations found in smoke screens in the open, is toxic in more concentrated form.

The 50-pound Floating Smoke Bomb Mk 1 Mod 2 differs from the Mod 1 in that it has a longer burning time, with a maximum of 7.5 minutes, as in the 100-pound Mk 3 Mod 0, and a minimum of 5 minutes.

Part 6 — Chapter 18 — Section 4

"AN" SERIES

2-pound Incendiary (Obsolete) AN–M52, AN–52A1, and AN–M52XA1

Over-all length, inches	14.22
Body length, inches	9.13
Body diameter, inches	1.68
Wall thickness, inch	0.35
Tail length, inches	5.79
Tail width, inches	1.68
Filling	Thermate
Weight of filling, pound	0.4
Total weight, pounds	2.0
Charge/weight ratio	20%

Construction: The hexagonal cast-magnesium alloy body weighs 1.13 pounds. The bore is one inch shorter than the body length, thus making a solid nose. There are three vent holes below the primer cap assembly, to assist in initial burning. The hexagonal sheet-metal tail is secured to the body with three screws.

Suspension

Cluster	Adapter	Size	Bombs
M10	M5	100#	42 AN–M52A1 9 AN–M52XA1
M11	M8	500#	153 AN–M52A1 39 AN–M52XA1

Filling: Thermate is a composition of 80% Thermite and 20% first fire charge:

THERMITE	FIRST FIRE CHG.	(a)	(b)
Iron oxide 76%	Sodium nitrate	50%	
Aluminum powder 24%	Aluminum powder	45%	75%
	Sulphur	4%	
	Boiled linseed oil	1%	
	Black powder		25%

Action: The spring-loaded safety plunger is depressed by the adjacent bomb; upon release from the cluster, it jumps out, leaving a thin brass cross holding the striker. On impact, the striker breaks free from the cross, igniting the primer, the first fire charge, and the thermate. The thermate burns, igniting the magnesium alloy case. The total burning time is eight minutes.

Remarks: In the Incendiary Bomb AN–M52A1, a primer of heavier metal is used, and the composition of the first fire charge is altered. The AN–M52XA1 incorporates an explosive charge; otherwise it duplicates the AN–M52A1.

4-pound Incendiary AN–M50 Series

AN–M50A1 (Obsolete)

Over-all length, inches	21.3
Body length, inches	13.4
Body diameter, inches	1.69
Tail length, inches	8.7

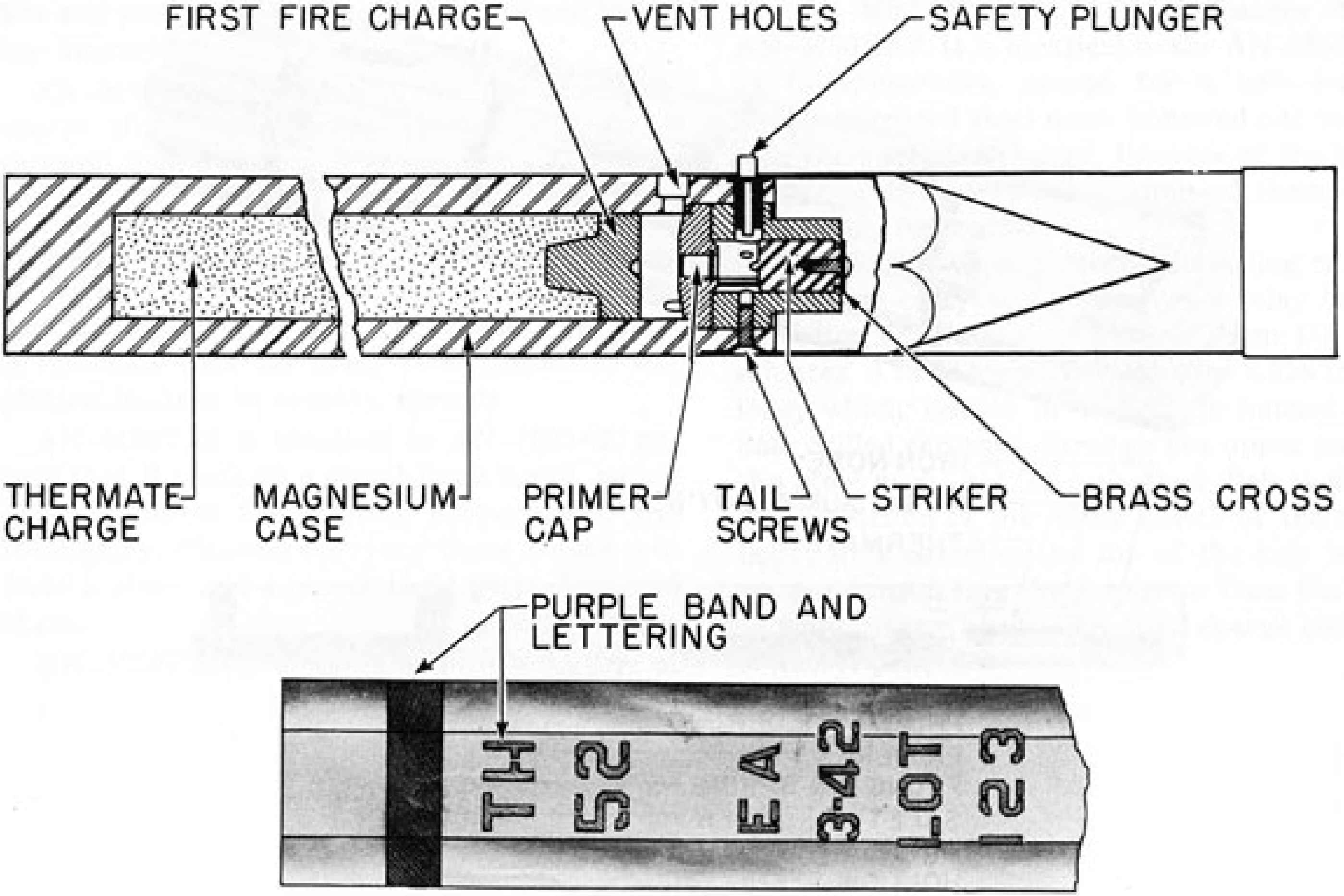


Figure 303. 2–pound Incendiary Bomb AN–M52

Tail width, inches.......................1.69
Filling ....Thermate
Weight of filling, pound...............0.63
Total weight, pounds....................3.6
Charge/weight ratio....................17%

Construction: The hexagonal body of magnesium alloy, weighing 1.25 pounds, has an iron nose plug. There are three vent holes below the primer cap assembly, to assist in initial burning. The hexagonal sheet-metal tail is secured to the body with three screws.

Operation: The spring-loaded safety plunger is depressed by the adjacent bomb; upon release from the cluster, it jumps out, leaving a thin brass cross holding the striker, which breaks free on impact and ignites the primer. The thermate burns, igniting the magnesium alloy case. The total burning time is 9.5 to 10.5 minutes.

Suspension

Cluster	Adapter	Size	Bombs
AN–M6	M5	100#	28 AN–M50A2
			6 AN–M50XA3
E31	M5	100#	34 AN–M50TA2
M7	M6	500#	102 AN–M50A2
			26 AN–M50XA3
AN–M14	M10A1	500#	104 AN–M50TA2
		Aimable	6 AN–M50XA3
AN–M14A1	M10A1	Aimable	22 AN–M50TXA3
			88 AN–M50TA2
M17	M10	500#	88 AN–M50A2
		Aimable	22 AN–M50XA3
AN–M17A1	M10A1	500#	88 AN–M50A2
		Aimable	22 AN–M50XA3

Remarks: AN – M50XA1, (Army: limited standard; Navy: obsolescent) contains 170 grains of black powder in a steel capsule at the nose, replacing a portion of the thermate. The bomb burns approximately 1.5 minutes, until the black powder explodes, scattering burning magnesium over a wide radius.

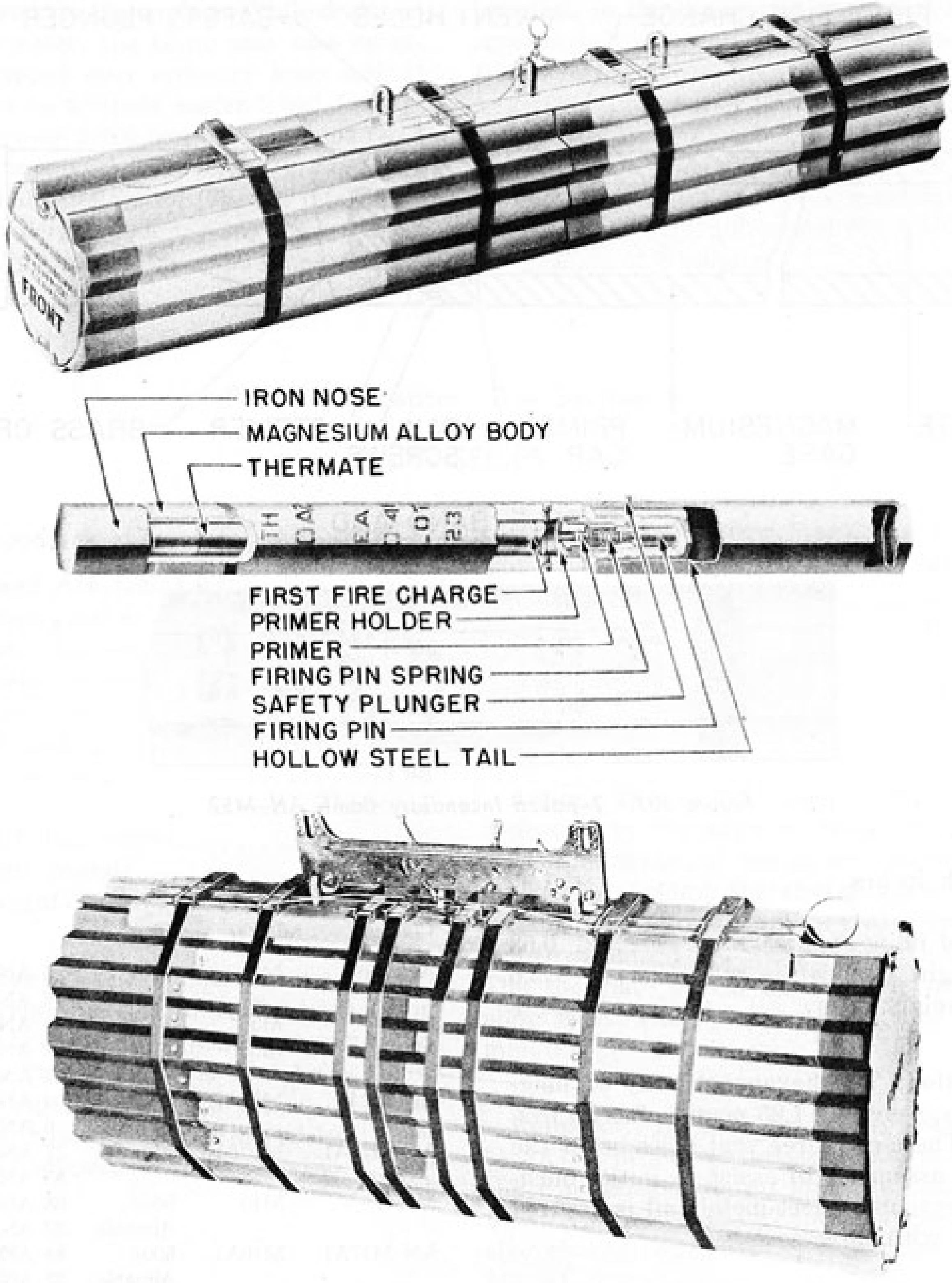


Figure 304. 4-pound Incendiary Bomb AN–M50A2

AN–M50A2, similar to AN–M50A1, is waterproofed around the primer cap and first fire charge.

AN–M50XA2, similar to AN–M50XA1, has an explosive head consisting of a steel nose cap which houses three tetryl pellets, a detonator, and a delay fuse. The delay fuse is ignited and sets off the detonator, exploding the tetryl pel-

lets and projecting fragments of steel and burning magnesium.

AN–M50XA3 is identical to AN–M50XA2, except that the assembly around the primer cap and first fire charge is waterproofed.

TYPE A AND TYPE B—AN–M50XA2 and AN–M50XA3 each have a Type A and a Type B. Type A indicates that the delay from impact to explosion is two to four minutes; Type B indicates that the delay from impact to explosion is sixty to seventy seconds.

AN–M50TA2 is identical to AN–M50A2, except that it contains a secret toxic agent, which does not affect the burning properties of the incendiary. Clusters carrying these bombs will have a green and a purple band painted around them.

AN–M50TXA3 combines the toxic feature of the AN–M50TA2 with the H.E. feature of the AN–M50XA3. It is identical to the AN–M50TA2 as to appearance, except for a new longer, double-mortised steel nose, hollowed out to contain the explosive charge. Because of the extra length of the nose, the column of therm–64C is $1\frac{1}{8}$ inches shorter.

The M50TXA3 is produced according to only one design or type, which gives a delay on the explosion of the H.E. charge of from $1\frac{1}{2}$ to 6 minutes. A heat-sensitive detonator 2.556 inches long, which ignites at 300° C. is housed in a hole drilled centrally through the upper part of the steel nose. A 1/16-inch steel disk is placed in the bottom of the filling cavity of the bomb body, thus covering the top of the hole in the nose and insulating the detonator from the heat of the burning bomb. The H.E. charge consists of tetryl pellets.

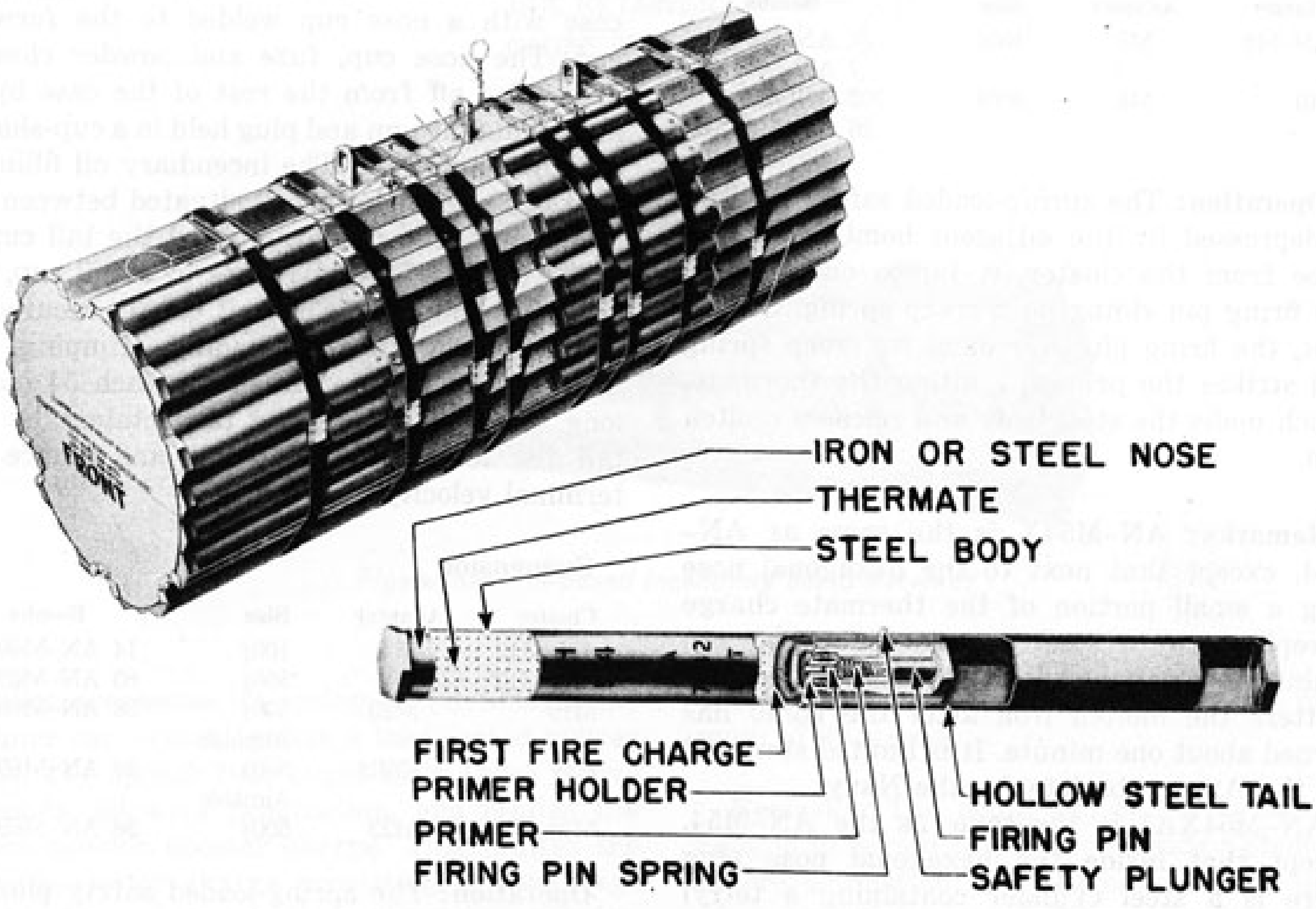


Figure 305. 4–pound Incendiary Bomb AN–M54

4-pound Incendiary AN–M54 Series (Obsolete)

	AN–M54
Over-all length, inches	21.35
Body length, inches	13.6
Body diameter, inches	1.69
Tail length, inches	10.0
Tail width, inches	1.69
Filling	Thermate
Weight of filling, pounds	1.6
Total weight, pounds	4.0
Charge/weight ratio	40%

Construction: The bomb body is a steel cylinder having a hexagonal nose plug. The fuze is installed in the tail plug assembly. There are three vent holes below the primer cap assembly, to assist in initial burning. There is a hexagonal hollow sheet-metal tail.

Suspension

Cluster	Adapter	Size	Bombs
AN–M8	M5	100#	27 AN–M54 7 AN–M54XA1
M9	M6	500#	102 AN–M54 26 AN–M54XA1

Operation: The spring-loaded safety plunger is depressed by the adjacent bomb; upon release from the cluster, it jumps out, leaving the firing pin riding on a creep spring. On impact, the firing pin overcomes its creep spring and strikes the primer, igniting the thermate, which melts the steel body and releases molten iron.

Remarks: AN–M54X is the same as AN–M54, except that next to the hexagonal nose plug a small portion of the thermate charge is replaced by a steel capsule containing 170 grains of black powder, which explodes and scatters the molten iron after the bomb has burned about one minute. It is limited standard for the Army, obsolete for the Navy.

AN–M54XA1 is the same as the AN–M54, except that inside the hexagonal nose plug there is a steel cylinder containing a tetryl high-explosive charge with a delay fuse and a detonator. A thin spacer of magnesium is between the thermate and the fuse opening of the explosive cylinder. After one minute of burning, the fuse is ignited, exploding the tetryl. These bombs are no longer being procured for naval service, and should not be used except when Incendiary Bombs AN–M50A2 or AN–M69 are not available. It is limited standard for the Army, obsolete for the Navy.

6-pound Incendiary AN–M69 and AN–M69X

Over-all length, inches	19.5
Body length, inches	19.5
Body diameter, inches	2.87
Wall thickness, inch	0.042
Tail length (streamer), inches	54.0
Filling	Gelled gasoline (NP or IM)
Weight of filling, pounds	2.8
Total weight, pounds	6.0
Charge/weight ratio	46%
Fuzing	M1

Construction: The bomb body is a hexagonal case with a nose cup welded to the forward end. The nose cup, fuze and powder charges are sealed off from the rest of the case by an impact diaphragm and plug held in a cup-shaped sealing diaphragm. The incendiary oil filling is held in a cheesecloth sock situated between the forward sealing diaphragm and the tail cup.

The tail assembly consists of a tail cup, tail retainer, and disc. The tail cup is secured to the hexagonal case by beading, crimping, and heating. Four gauze streamers, each 54 inches long, are attached to the tail retainer by the tail disc to stabilize the bomb and reduce the terminal velocity.

Suspension

Cluster	Adapter	Size	Bombs
AN–M12	M4	100#	14 AN–M69
AN–M13	M7	500#	60 AN–M69
M19	M23	500# Aimable	38 AN–M69
E28	E6R2	500# Aimable	38 AN–M69
M21 (E74)	M23	500#	38 AN–M69X

Operation: The spring-loaded safety plunger jumps out of the Fuze M1 upon release from the cluster, arming the fuze. On impact, the

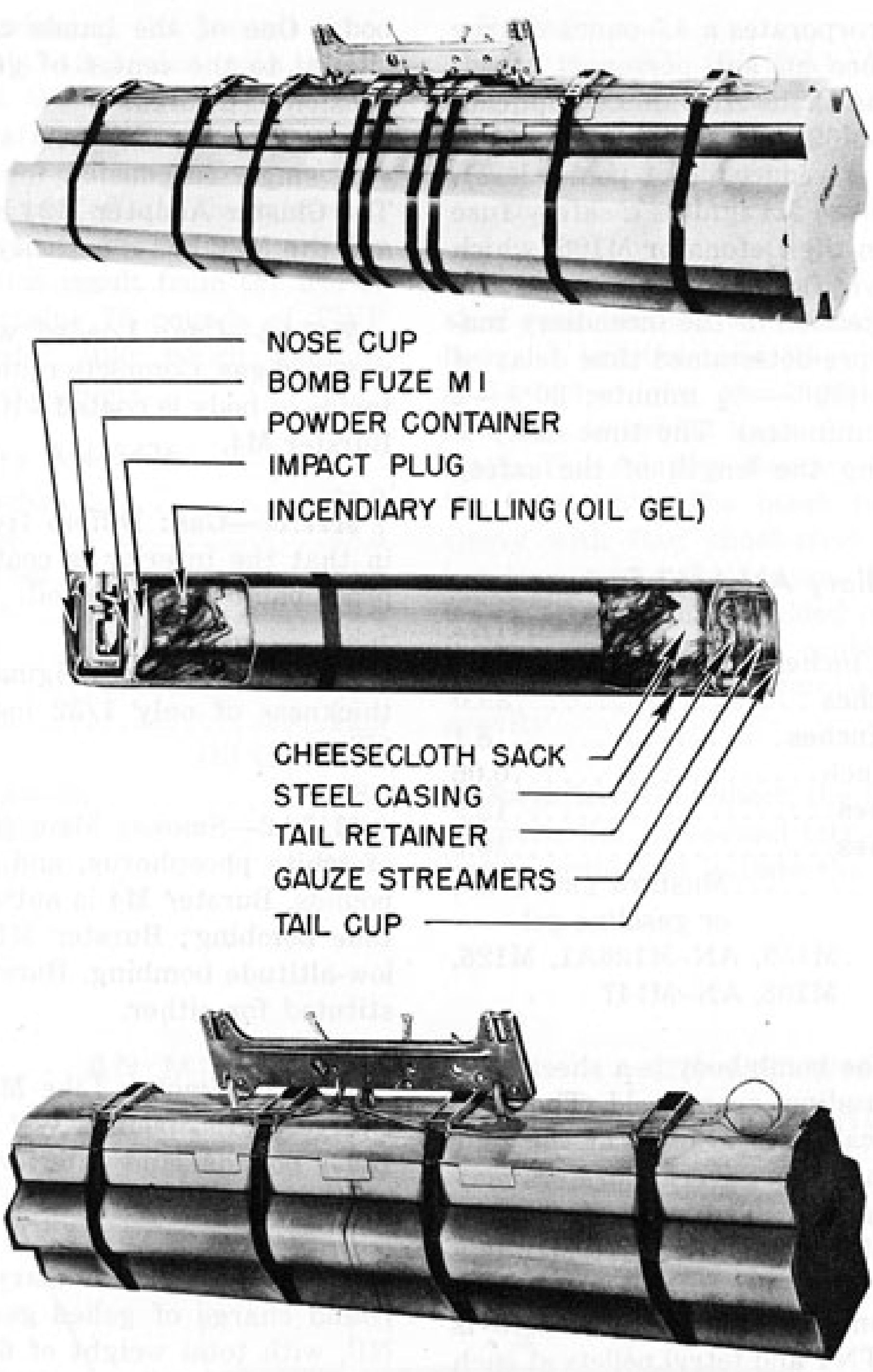


Figure 306. 6–pound Incendiary Bomb AN–M69

striker overcomes its spring and detonates the primer cap, which ignites a lead-coated spitter fuse. The spitter fuse burns from three to five seconds, allowing penetration, and ignites the black-powder booster charge. This ignites the igniter-ejector charge consisting of two bags of black powder and oiled magnesium powder. The combustion blows off the tail cup, ignites the incendiary filling and ejects it for a maximum of 75 yards.

Remarks: The bomb and the delay are calculated to permit penetration inside a structure before detonation. The incendiary oil filling is of a very sticky composition and will normally adhere to any object, including vertical walls.

The AN–M69X incorporates a 4.5-ounce charge of tetryl to produce an anti-personnel effect. Over-all dimensions of the AN–M69X duplicate those of the AN–M69, but the amount of incendiary mixture is reduced (0.4 pound less). Operation of the Fuze M1 ignites a safety fuse lead terminating in the Detonator M106, which explodes the tetryl, fragmenting 65% of the bomb case after ejection of the incendiary material, following a pre-determined time delay of 0.5 to 6 minutes (30%—½ minute; 30%—2 minutes; 40%—6 minutes). The time delay is varied by adjusting the length of the safety fuse.

100-pound Incendiary AN–M47 Series

	AN–M47A2
Over-all length, inches	48.9
Body length, inches	39.0
Body diameter, inches	8.1
Wall thickness, inch	0.06
Tail length, inches	12.9
Tail width, inches	10.9
Filling	Mustard gas, W.P., or gasoline gel
Fuzing	M159, AN–M126A1, M126, M108, AN–M147

Construction: The bomb body is a sheet-steel tube with a longitudinal seam weld. The nose end is hemispherical. A base plate at the rear end is welded to the tube. Several bursters may be used interchangeably. The burster runs the length of the bomb. The Burster AN–M12 is a tube containing a 50-50 mixture of black powder and magnesium. The Burster AN–M13 is a tube containing TNT and tetryl pellets at each end, and is used in conjunction with the Igniter AN–M9 (WP or Na). The Na igniter will permit use over water. Four vanes are welded to a truncated cone with box-type interior struts to form the tail.

Suspension: Horizontal suspension is provided by two eyebolts formed by holes in each half of the two suspension bands, the halves then being crimped together to form a complete band. The bands are secured to the bomb body by tightening the bolts on the underside of the body. One of the bands can be loosened and slipped to the center of gravity if single suspension is desired.

Two clusters are now standardized to provide single suspension for four to six bombs. The Cluster Adapter M24 holds six AN–M47's; and the M22 has a capacity of four AN–M47's.

M47A2—Gas: Loaded with 68.5 pounds of mustard gas. Complete round weighs 98 pounds. Inside of body is coated with oil. Equipped with Burster M4.

M47A1—Gas: Differs from the M47A2 only in that the interior is coated with black acid-proof paint instead of oil.

M47—Chemical: Original design, has wall thickness of only 1/32 inch. Not used for H filling.

M47A2—Smoke: Main filling is 100 pounds of white phosphorus, and total weight is 127 pounds. Burster M4 is authorized for high-altitude bombing; Burster M18 is authorized for low-altitude bombing. Burster M7 may be substituted for either.

M47A1—Smoke: Like M47A2—Smoke, with charge of 103 pounds WP and total weight of 129.5 pounds, and interior coated with black acid-proof paint.

AN–M47A2 — Incendiary: Loaded with 40-pound charge of gelled gasoline, either IM or NP, with total weight of 68.6 pounds. Burster AN–M13 and Igniter AN–M9 (WP or Na) authorized for this bomb.

M47A1—Incendiary: Like AN–M47A2, with interior coating of acid-proof paint instead of oil.

AN–M47A3 — Incendiary: Identical to AN–M47A2, except that tail assembly is three inches longer.

AN–M47A4—Incendiary: On this modification, the suspension lugs are strengthened.

The Navy is procuring, at the present time, Incendiary Bombs M47A2 loaded with PWP. PWP consists of 75% WP and 25% plasticizer; it is more effective than WP, since it gives longer burning, reduces pillaring effect, and increases the anti-personnel effect. The increased smoke efficiency is due to the larger particles of controlled size which result from the use of PWP. The bomb contains 75 pounds of PWP and requires a Burster M20, which contains ¾-inch-diameter tetryl pellets.

500-pound Incendiary AN–M76

Over-all length, inches	59.2
Body length, inches	45.3
Body diameter, inches	14.0
Wall thickness, inch	0.3
Tail length, inches	13.9
Tail width, inches	14.8
Tail weight, pounds	12.3
Filling	Oil Gel PT 1
Weight of filling, pounds	180
Total weight, pounds	475
Charge/weight ratio	38%

Fuzing

NOSE — AN – M103A1, AN – M103, M103, M135A1, M136, M136A1, M139, M139A1, AN–M139A1, M140, M140A1, AN–M140A1, M163, M164, M165, M166, T82.

TAIL—AN–M101A2, AN–M101A1, M161.

Construction: The body is of one-piece cast-steel construction, with a base plate welded to body. A burster tube 3.5 inches in diameter, 35.75 inches long, running through the center of bomb, is welded to the nose and to the base plate. The Adapter Booster M115 screws into the base plate. The bomb tail is a cast-steel sleeve with four sheet-steel fins and internal box-type struts. Suspension is accomplished by two suspension lugs welded on the body seven inches on each side of center of gravity and by a single lug, 180° removed at the center of gravity.

Operation: On impact, the fuzes function and detonate the 1.25-pound tetrytol burster in the burster tube and initiate the nine-pound white

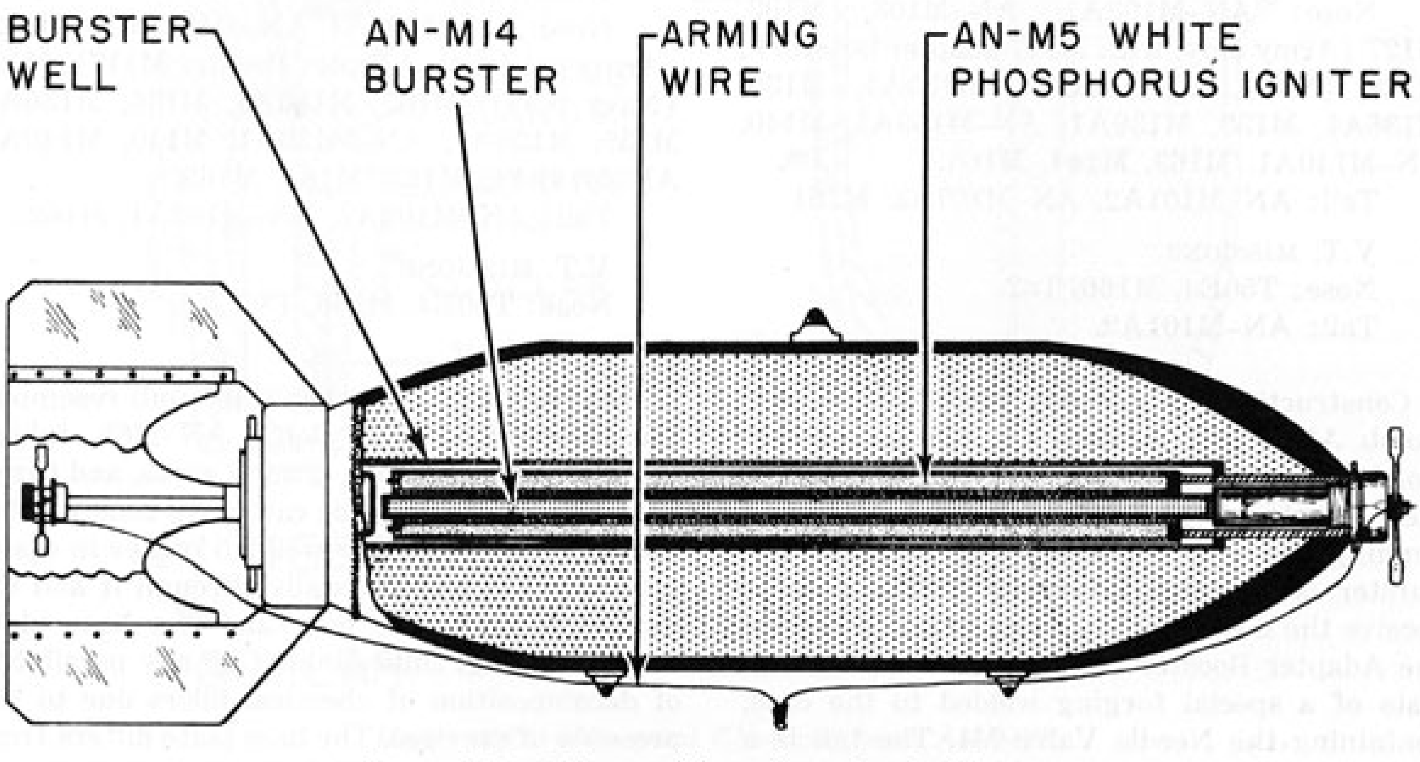


Figure 307. 500–pound Incendiary Bomb AN–M76

phosphorus igniter, which, in turn, ignites the main filling. The bomb has a dispersal area of about 300 by 600 feet.

Remarks: White phosphorus is present in the igniter, and proper precautions should be taken in disposing of these bombs. The incendiary mixture, PT 1, consisting essentially of paste of magnesium, gasoline, and a thickener, liberates heat at about four times that given off by the usual incendiary mixture IM.

500-pound Chemical AN–M78

Over-all length, inches	59.25
Body length, inches	46.7
Body diameter, inches	14.0
Wall thickness, inch	0.3
Tail length, inches	13.9
Tail width, inches	18.9
Tail weight, pounds	12.3

Filling	Hydrocyanic acid (AC)	Phosgene (CG)	Cyanogen Chloride (CK)
Wt. of filling	100#	205#	165#
Total weight	383#	488#	448#
Chg./wt. ratio	26.1%	42.0%	36.8%

Fuzing

REGULAR MISSIONS

Nose: AN–M103A1, AN–M103, M103, M127 (Army only, with M117 adapter booster); M128 (Navy only), M135, M135A1, M136, M136A1, M139, M139A1, AN–M139A1, M140, AN–M140A1, M163, M164, M165.

Tail: AN–M101A2, AN–M101A1, M161.

V.T. MISSIONS

Nose: T50E4, M166, T82.

Tail: AN–M101A2.

Construction: In construction, the Chemical Bomb AN–M78 resembles the 500-pound G.P. Bomb AN–M64. The body is of one-piece cast-steel construction with a Burster M15 well running the entire length of the bomb. The burster is threaded internally at the nose to receive the nose fuze and at the rear to receive the Adapter Booster M115. The base plug consists of a special forging welded to the case, containing the Needle Valve M1. The tail is a standard box-type fin assembly secured to the bomb by a locking nut which threads onto the base plug. Suspension is by two lugs seven inches on either side of the center of gravity, or by a single suspension lug 180° removed at the center of gravity.

Remarks: The Adapter Booster M117 is used in conjunction with the Nose Fuze M127. This nose fuze is required for aerial bursts with persistent gas agents.

1,000-pound Chemical AN–M79

Over-all length, inches	69.5
Body length, inches	53.6
Body diameter, inches	18.6
Wall thickness, inch	0.38
Tail length, inches	18.5
Tail width, inches	25.4
Tail weight, pounds	21.5

Filling	Hydrocyanic acid (AC)	Phosgene (CG)
Wt. of filling	185#	404#
Total weight	707#	926#
Chg./wt. ratio	26.0%	44.0%

Fuzing

REGULAR MISSIONS

Nose: AN–M103A1, AN–M103, M103, M127 (Army only with Adapter Booster M117), M128 (Navy only), M135, M135A1, M136, M136A1, M139, M139A1, AN–M139A1, M140, M140A1, AN–M140A1, M163, M164, M165.

Tail: AN–M102A2, AN–M102A1, M162.

V.T. MISSIONS

Nose: T50E4, M166, T82.

Construction: This chemical bomb resembles the 1,000-pound G.P. Bomb AN–M65, taking the same tail assembly, arming wires, and fuzes. The body is of one-piece cast-steel construction and has a steel burster well 2.5 inches in diameter which is placed axially through it and expanded in both the nose and the base plate before welding, thus eliminating any possibility of decomposition of chemical fillers due to the presence of crevices. The base plate differs from that of the standard G.P. bomb in that it is a

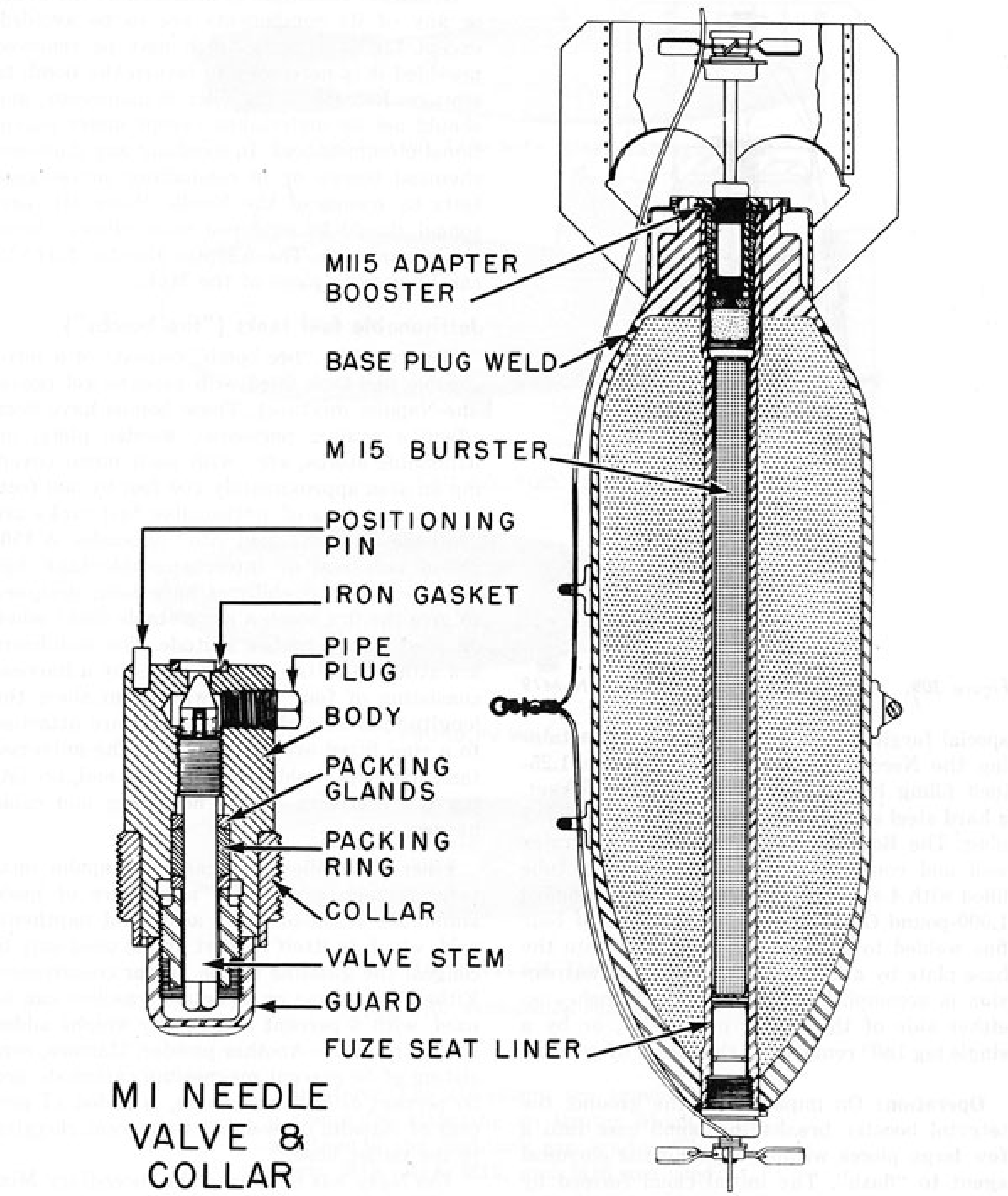


Figure 308. 500-pound Chemical Bomb AN-M78

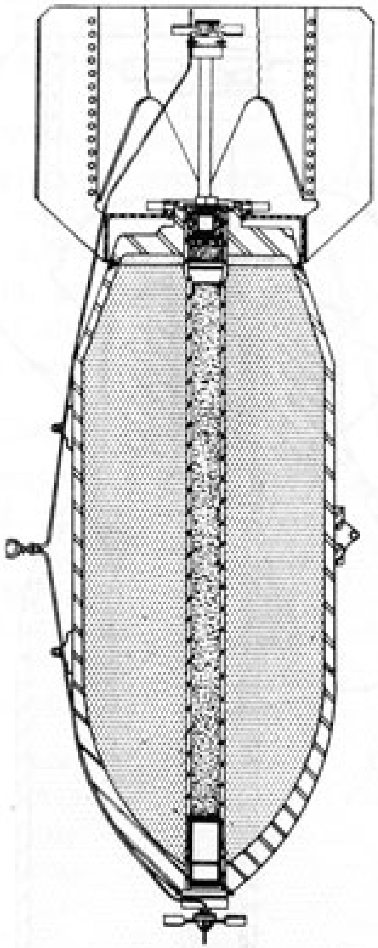


Figure 309. 1,000-pound Chemical Bomb AN-M79

special forging welded to the case and containing the Needle Valve M1. It also has a 1.25-inch filling hole closed by a soft iron gasket, a hard steel gasket plug, and a threaded closing plug. The Booster M16 is used in the burster well and consists of a waterproof fiber tube filled with 4.45 pounds of tetrytol. The standard 1,000-pound G.P. tail assembly consists of four fins welded to a sleeve which is held onto the base plate by a locking nut. Horizontal suspension is accomplished by dual lugs 7 inches on either side of the center of gravity, or by a single lug 180° removed at the center of gravity.

Operation: On impact with the ground, the tetrytol booster breaks the bomb case into a few large pieces without causing the chemical agent to "flash". The initial cloud formed by the burst of this bomb, when filled with CG, covers an area of 100 yards in diameter within approximately eight to ten seconds.

Remarks: Attempts to disassemble the bomb or any of its components are to be avoided, except for the fuzes, which may be removed provided it is necessary to return the bomb to storage. Release of the filler is dangerous, and should not be undertaken except under exceptional circumstances. In handling any damaged chemical bombs or in conducting surveillance tests by means of the Needle Valve M1, personnel should be equipped with rubber gloves and a gas mask. The Adapter Booster M115A1 can be used in place of the M115.

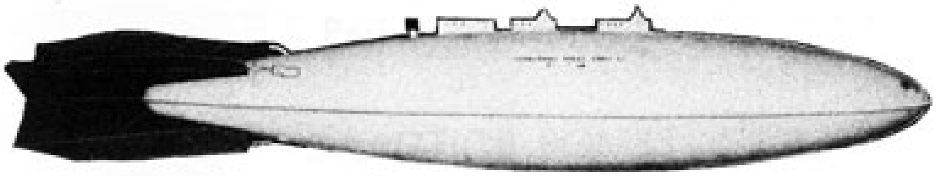
Jettisonable fuel tanks ("fire bombs")

General: The "fire bomb" consists of a jettisonable fuel tank filled with gasoline gel (gasoline-Napalm mixture). These bombs have been effective against personnel, wooden piers, inflammable stores, etc., with each bomb covering an area approximately 100 feet by 300 feet.

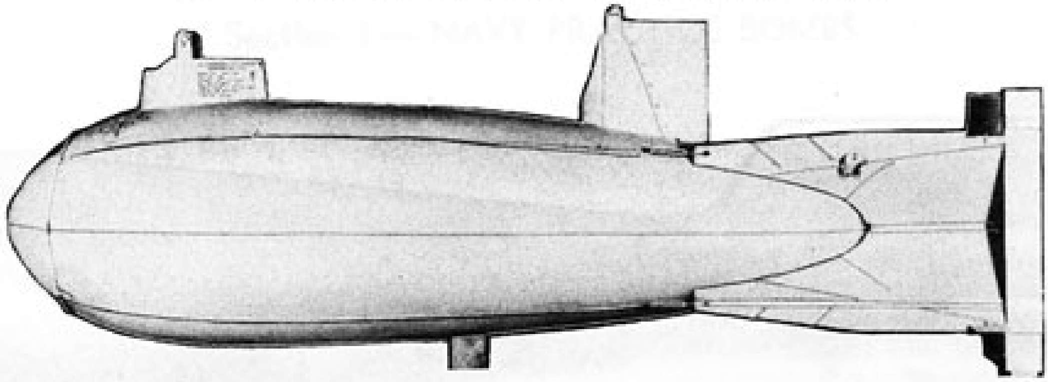
Various types of jettisonable fuel tanks are available for conversion into fire bombs. A 150-gallon universal or interchangeable tank has been produced. Stabilizers have been designed to give the fire bomb a more stable flight when dropped from a higher altitude. The stabilizers are attached to the present tanks by a harness consisting of four cables which run along the longitudinal axis of the tank and are attached to a ring fitted around the nose. The universal tank has clips welded to the after end, obviating the necessity of the nose ring and cable harness.

Filler: The filler is a gasoline-Napalm mixture. Napalm consists of a mixture of basic aluminum soaps of fatty acids and napthenic acid, which in itself is inert and is used only to congeal the gasoline to the proper consistency. Either 100 octane or 80 octane gasoline can be used, with 6 percent Napalm by weight added for the mixture. Another powder, Marinco, consisting of 50 percent magnesium carbonate and 50 percent calcium carbonate, is added (7 percent of Napalm by weight) to prevent clogging in the outlet hose.

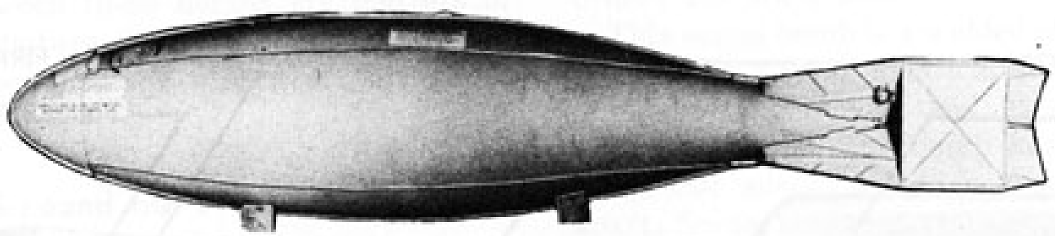
The Navy has developed the Incendiary Mixers Mk 1 Mod 0 and Mk 1 Mod 1, which mix the gasoline and Napalm in the correct proportions.



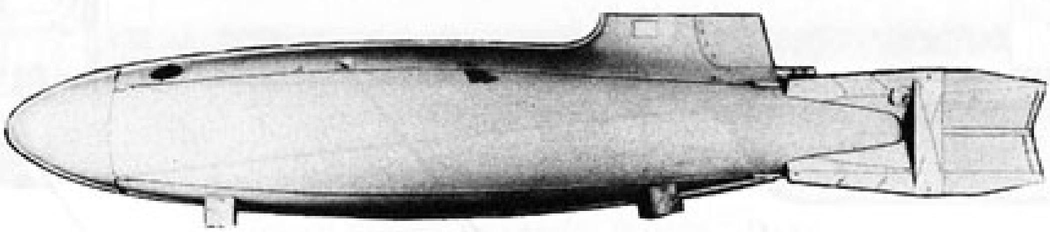
UNIVERSAL FUEL TANK WITH STABILIZER ATTACHED



F4U C/L FUEL TANK



F4U-ID, PV WING PYLON TANK



F6F FUSELAGE TANK

Figure 310. Jettisonable Fuel Tanks

Igniters: The stabilizers are provided with a clamp for attaching an igniter which is in addition to the fuel-tank cap igniter. The Igniters M13, M14, M15, and M16 are used.

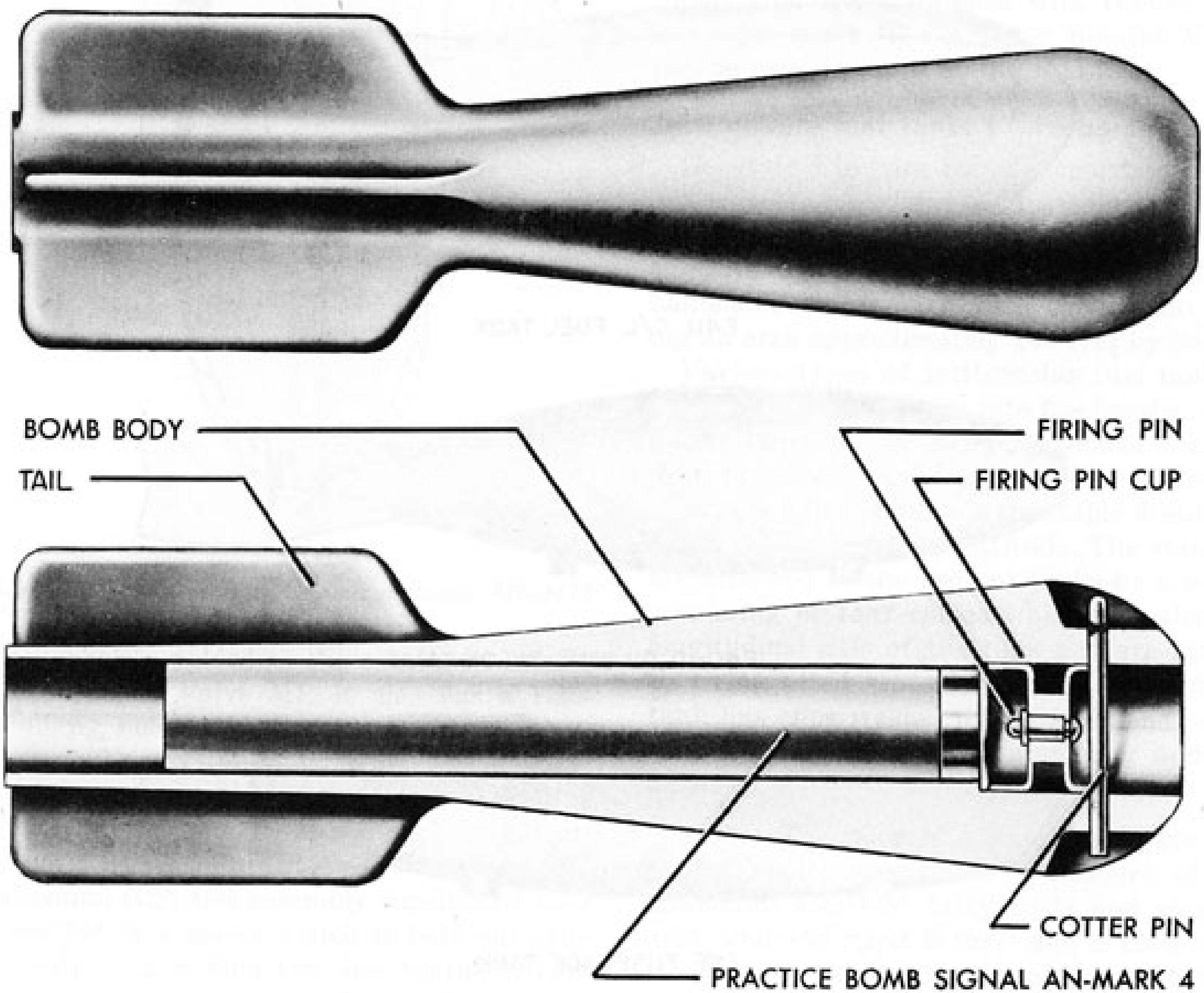


Figure 311. 4.5–pound Miniature Practice Bomb AN–Mk 43

PRACTICE BOMBS

Section 1 — NAVY PRACTICE BOMBS

Miniature 3-pound Mk 3, Mk 4, AN–Mk5, and AN–Mk 23; and 4.5-pound AN–Mk 43

Over-all length, inches 8.25
Diameter, inches 2.18
Color . . . . Unpainted

These small, cast-alloy bombs have a tube along their longitudinal axis which houses the Signal Cartridge AM–Mk 4 or Mk 5, a pyrotechnic charge for spotting purposes. The differences between these bombs are matters of size. The Miniature Practice Bomb AN–Mk 43 weighs 4.5 pounds; the others of this series weigh 3.0 pounds.

Miniature 13-pound Mk 19 or Mk 19 Mod 1

This bomb is like the other miniatures, except that it is larger. Its length is 13.0 inches, while its weight is 13.0 pounds.

"Old" Series Practice Bombs (Obsolete or being replaced)

No fuzes are used in these bombs, and they contain no spotting charge, being filled either with water or with wet sand. The filling is usually stencilled on the body of the bomb. To prevent freezing and splitting of cases at high altitudes, anti-freeze is added. To improve spotting of hits, a spotting dye is also used.

"New" Series Practice Bombs

Mk 15 Mod 3 uses Spotting Signal Mk 7; the others use Mk 6 Mod 0.

This series bomb is a welded sheet-steel light-case design having identical dimensions to AN standard G.P. bombs, and uses AN standard G.P. bomb tails. The bomb has, welded to its body, two suspension lugs spaced 14.0 inches apart. Seven threaded recesses, located on the periphery at the approximate center of gravity, are for various hoisting conditions. At 90 degrees, on each side of the suspension lugs and slightly before the hoisting recesses, are threaded openings to receive trunnions.

By means of a strap, the appropriate practice bomb signal, Mk 6 or Mk 7, may be at-

"OLD" SERIES PRACTICE BOMBS—DATA

		Length	Diameter	Color	Total Weight Water-Filled	Total Weight Wet-Sand-Filled
100-lb.	Mk 7	41.2"	8.0"	Black	48.5 #	83.0 #
100-lb.	Mk 15 Mod 2	41.2"	8.0"	Black	56.0 #	95.0 #
500-lb.	Mk 5	67.3"	16.0"	Black	360.0 #	500.0 #
500-lb.	Mk 11	61.8"	15.0"	Black	268.0 #	448.0 #
500-lb.	Mk 21	61.8"	15.0"	Black	273.0 #	489.0 #
1,000-lb.	Mk 7	80.0"	19.0"	Black	580.0 #	1,000.0 #
1,000-lb.	Mk 22	79.0"	19.0"	Black	573.0 #	1,013.7 #

"NEW" SERIES PRACTICE BOMBS—DATA

		Length	Diameter	Water-Loaded	Sand-Loaded
100-lb.	Mk 15 Mod 3	41.2"	8.0"	64.25 #	100 #
500-lb.	Mk 65 Mod 0	56.6"	14.0"	220.0 #	388.0 #
1,000-lb.	Mk 66 Mod 0	67.0"	18.6"	474.0 #	834.0 #
2,000-lb.	Mk 67 Mod 0	90.15"	23"	..	733.0 #

tached to the tail assembly with the forward end of the signal seated in a recess in the after end of the bomb body.

A flat-nose attachment has been designed for use with the Practice Bomb Mk 15 Mod 3 for anti-submarine bombing practice. The flat nose is installed by removing the nose-filling cap, slipping the attachment over the nose of the bomb, and then screwing the filling cap down tightly by hand to hold the attachment in place. The flat nose will prevent ricochet at entrance angles as low as 9°.

The 2,000-pound-size container was designed for an incendiary or practice filler but, thus far, it is approved by the Bureau of Ordnance for practice filling, sand, only. As designed for incendiary loads, it would take a nose fuze, the Burster Mk 1, and the Igniter Mk 40; however this is subject to change before Bureau approval of the bomb as an incendiary. The Mk 67 has standard suspension lugs and provision for trunnions.

Practice Bomb Signals (Navy)

AN–Mk 4 and AN–Mk 5: For the miniature practice bombs, these signals allow observers to spot the impact of salvos. The Practice Signal Cartridge AN–Mk 4 is an extra long 10-gauge shotgun shell which is inserted in the nose of the bomb. On impact, the cartridge is fired, expelling a large puff of black smoke from the tail of the bomb. The firing device consists of two shallow cups separated by a spacer, the firing pin extending through the bottom of one cup. The Signal Cartridge Mk 5 is the same size but filled with fluorescein, which stains the water, giving a spot of longer duration than the AN–Mk 4.

Mk 6 Mod 0 and Mk 7 Mod 0: These signals are essentially cans of black powder fitted with the Fuze Mk 247. The Mk 6 is used in the Practice Bombs Mk 65 and Mk 66; the Mk 7 in the Bomb Mk 15 Mod 3. They are attached to the rear of the bomb by brackets or a strap arrangement. The Signal Mk 7 is 13.08 inches long and 2 inches in diameter. It has a total weight of 2.5 pounds. It has a filling of one pound of black powder. The Mk 6 is generally the same, except that the fuze is mounted off-center and the black-powder filling weighs two pounds.

The Fuze Mk 247 consists of an inertia weight held by a jump-out pin and a creep spring. The detonator is a blank caliber .38 cartridge. When the signal is placed in the bomb, the firing pin assembly is unscrewed and a blank caliber .38 cartridge inserted in the cartridge chamber. The firing assembly is then re-inserted and secured by means of a lock nut. At the time of loading the bomb into the plane, the arming wire is inserted through the jump-out pin, and the safety pin is then removed. Upon release from the plane, the arming wire is withdrawn, allowing the jump-out pin to be thrown free, arming the signal. Upon impact, the weighted firing pin overcomes the creep spring and impinges upon the primer of the caliber .38 blank cartridge, which, in turn, ignites the main black-powder charge.

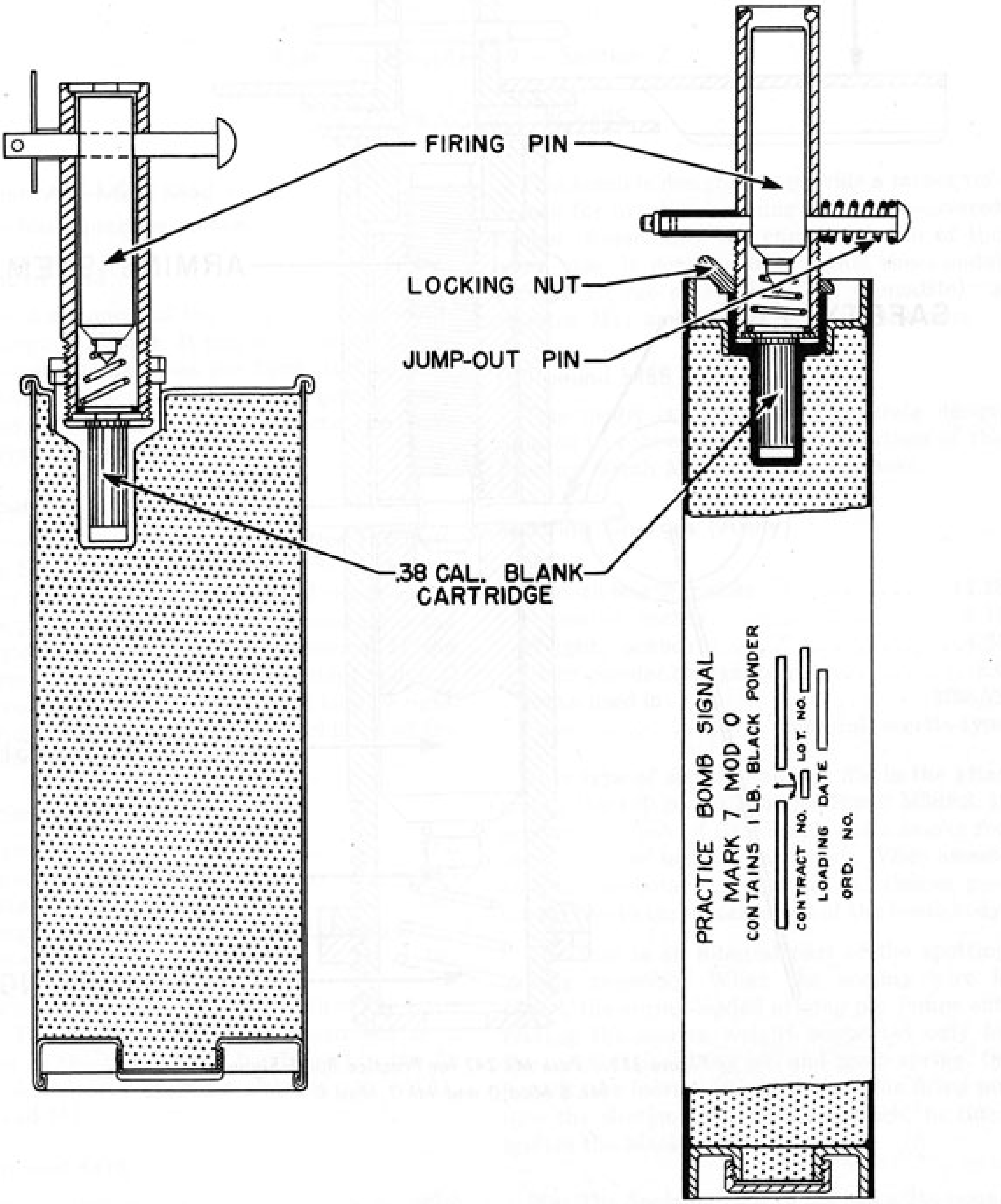


Figure 312. Practice Bomb Signals Mk 6 Mod 0 (left) and Mk 7 Mod 0 (right)

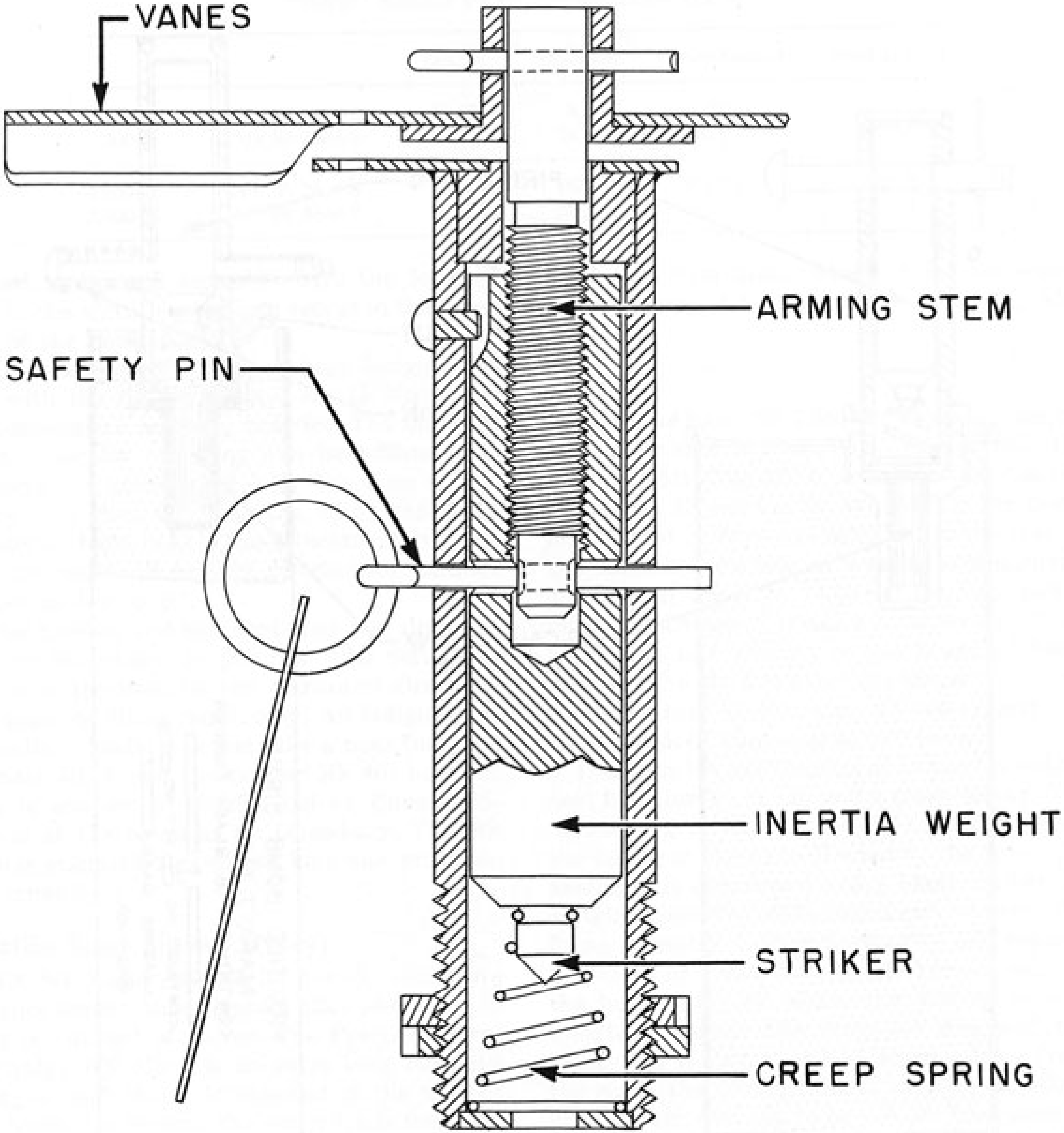


Figure 313. Fuze Mk 247 for Practice Bomb Signals Mk 6 Mod 0 and Mk 7 Mod 0

ARMY PRACTICE BOMBS

3-pound AN–Mk 5 Mod 1

See Navy practice bombs.

20-pound M48

This is a dummy of the 20-pound Fragmentation Bomb AN–M41. It has a two-ounce black-powder charge and uses the Fuze M110 or AN–M110A1 in the nose. It is 21.8-inches long; weighs 19.7 pounds. It is issued in practice bomb clusters M2 and M2A1.

23-pound M71 and M71A1

These are parachute-type practice fragmentation bombs for clustering. They do not have a fuze or spotting charge, because of the presence of the parachute. The parachute assembly is the M3, modified from the M4 by removal of the suspension assembly, hand assembly, and pull wire container. M71 is 26.8 inches long; weighs 21 pounds. M71A1 differs by the addition of the shoulder to the bomb nose.

100-pound M38A2

Over-all length, inches	47.5
Diameter, inches	8.13
Weight, empty, pounds	15.7
Weight, sand-loaded and spotting charge, pounds	100

This bomb simulates a G.P. bomb of the same size. The spotting charge is assembled in a sleeve at the base of the bomb, within the fin box. Authorized spotting charges are M1A1, M3, and M4.

100-pound M75

Length, inches	47.0
Diameter, inches	8.0
Filler, hematite, pounds	72
Total weight, pounds	101.3

This bomb is designed to provide a target reference for practice bombing over snow-covered ranges. Resembling the chemical bomb of the same size, it consists of a light, sheet-metal case; a charge of red iron ore (hematite); a Burster M4; and a Fuze M108 in the nose.

100-pound M85

This model is a reinforced concrete design ordered to relieve a temporary shortage of the Practice Bomb M38A2 during the war.

Spotting Charges (Army)

M1A1

Over-all length, inches	11.18
Diameter, inches	3.43
Weight, pounds	4.25
Black-powder charge, pounds	3.0
Bomb used in	M38A2
Fuze	Integral inertia-type

This type of spotting charge fits in the after end of the 100-pound Practice Bomb M38A2. It produces a flash of flame and white smoke for observation of bombing accuracy. When assembled in the bomb, the can of the charge protrudes two to three inches out of the bomb body.

The fuze is an integral part of the spotting charge assembly. When the arming wire is pulled, the spring-loaded arming pin jumps out, leaving the inertia weight supported only by the combination firing pin and creep spring. On impact, the inertia weight drives this firing pin into the shotgun-type primer, which, in turn, ignites the black powder.

M3: The Spotting charge M3 has a 2⅓-pound dark smoke filling and a black-powder igniter. It is ⅝ inch longer than the Spotting Charge M1A1, but otherwise is like it. The M3, with

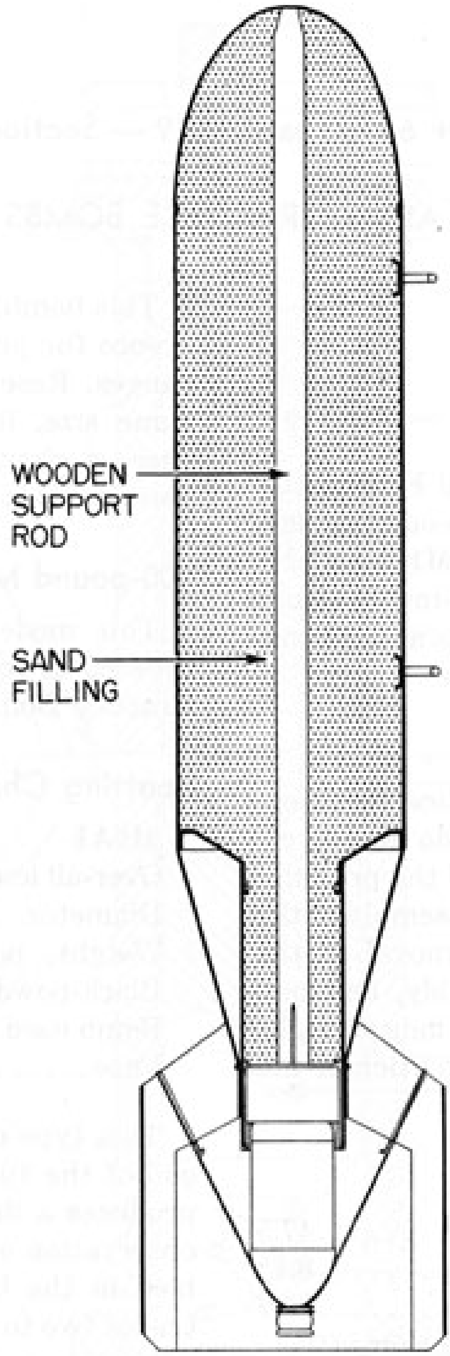


Figure 314. 100–pound Practice Bomb M38A2

its dark smoke filler, is well adapted for bombing practice over snow-covered terrain. The black-powder igniter charge contains approximately 425 grains. It is used in the Practice Bomb M38A2.

M5

Over-all length, inches	7.37
Diameter, inches	2.95
Material	Glass
FS filler, fluid ounces	14.4

The Spotting Charge M5 consists of a glass bottle filled with FS smoke mixture. An ordinary bottle cap seals the mixture. The bottle is held to the Practice Bomb M38A2 by a wire twisted around the neck of the bottle and attached to the tail vanes. The charge assembly weighs 2.54 pounds.

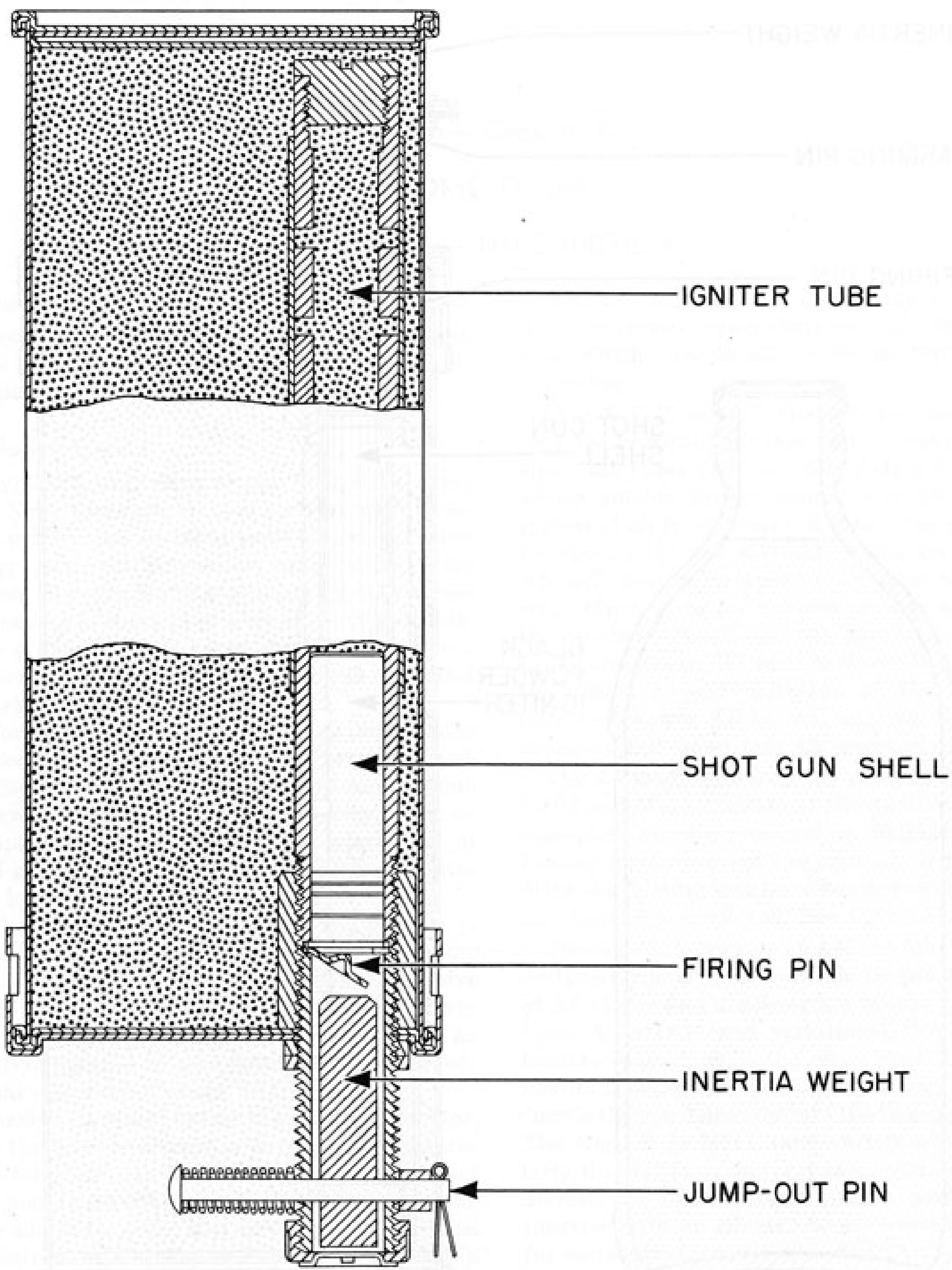


Figure 315. Spotting Charge M1A1

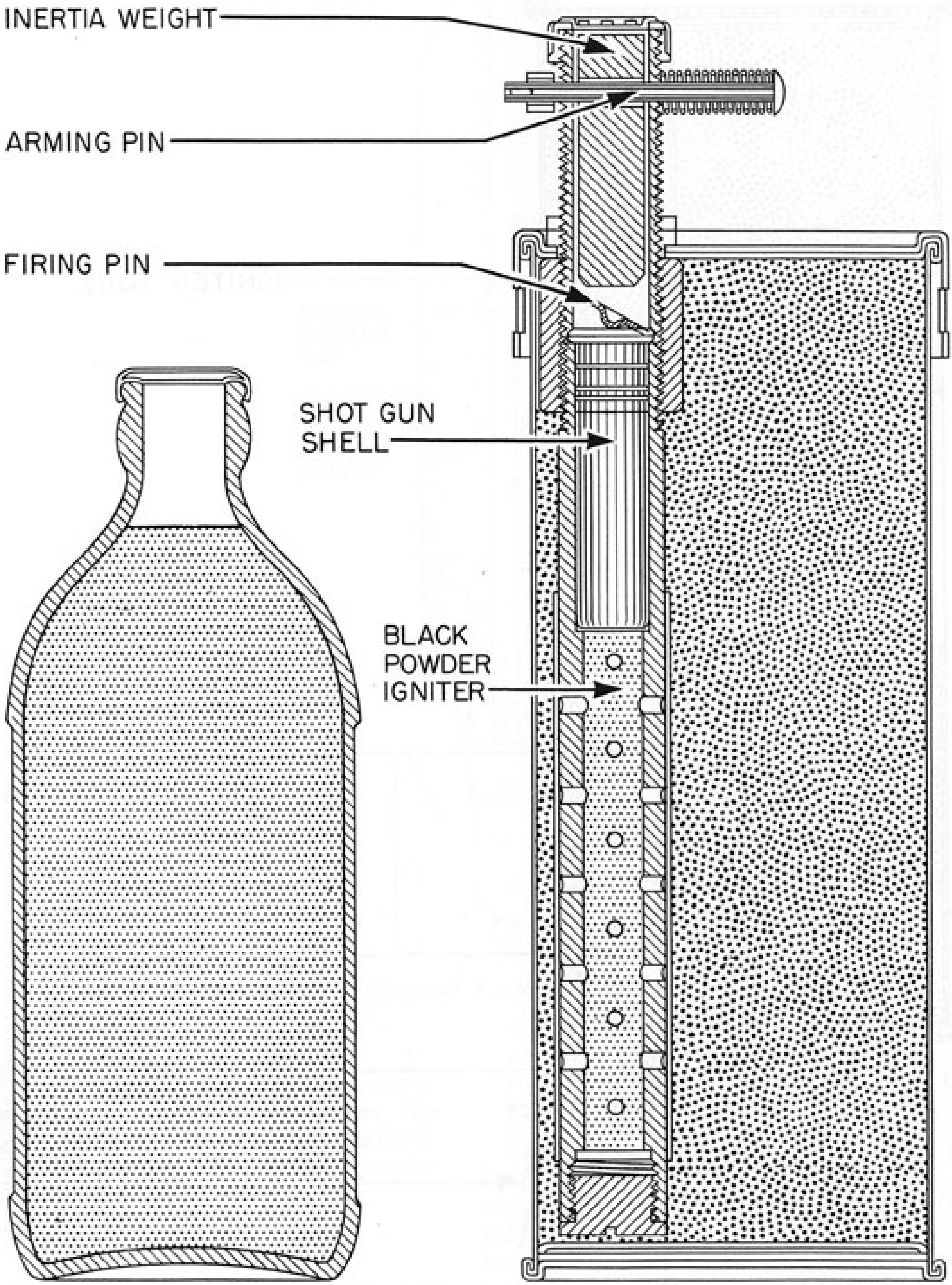


Figure 316. Spotting Charges M3 (right) and M5 (left)

Part 6 — Chapter 20

BOMB FUZES

Section I — INTRODUCTION

General

Because of the nature of their development, it is necessary to classify bomb fuzes in this publication as either Army or Navy items.

Explosive train

Typical firing trains employed in both Army and Navy fuzes use pointed strikers with sensitive primers for instantaneous action and blunt firing pins and percussion primers for delay action. The simple instantaneous explosive train in nose fuzes consists of a sensitive primer mixture of lead azide and lead styphnate, an upper detonator of lead azide, and a lower detonator of tetryl.

For a short delay, the blunt firing pin initiates a mercury-fulminate percussion primer, which sends a flash through a chamber of compression to ignite a pressed black-powder delay. This, on completion of burning, flashes a relay pellet of lead azide and lead styphnate, which detonates the lower detonator of tetryl.

The explosive train, including the booster, is usually incorporated in all Navy fuzes and Army nose fuzes; but in Army tail fuzes the explosive train does not include the booster, and may have the remainder of its explosives contained in an interchangeable primer detonator to allow optional selection of short delays.

Army tail fuzes contain the primer detonator, but the booster charge is housed in an adapter booster which is considered an integral part of the bomb base plug and should not be removed. The adapter booster also serves to seat the fuze.

Four standard adapter boosters are found in the base plugs of Army bombs; the M102, M102A1, M115, and the M115A1. Since the inside thread diameter of the M102 and M102A1 is 1.5 inches, bombs fitted with these adapter boosters receive Army-designed tail fuzes only, all of which have an outside thread diameter of 1.5 inches.

In AN G.P. bombs, the adapter booster is modified to permit the insertion of Navy hydrostatic tail fuzes (AN–Mk 230 Mods 4, 5, and 6) whose outside thread diameter is 2.0 inches, typical of all Navy-designed fuzes. The Adapter Boosters M115 and M115A1, which are used in AN G.P. bombs incorporate an inner sleeve or ring, which gives the adapter booster an inside thread diameter of 1.5 inches, permitting Army-type fuzing only. When this sleeve is removed, the inside thread diameter of the adapter booster becomes 2.0 inches, and the Navy hydrostatic tail fuzes may be inserted.

The A1 modification on the Adapter Boosters M102 and M115 consists of the addition of two base-plate locking pins and an adapter-booster locking pin to prevent the removal of the base plate and adapter booster when anti-withdrawal tail fuzes are employed. See figure 317.

The nose fuze pockets of AN and other Army-designed bombs have an inside thread diameter of 2.0 inches and are designed to take the Nose Fuze AN-M103 (and variations). No adapter booster is used, since the Nose Fuze AN-M103 has its booster built into the fuze body and the fuze is threaded directly into the fuze seat liner. The Nose Fuze M111 (and variations, particularly the M127), however, has an outside thread diameter of 1.5 inches and must be used in conjunction with an adapter booster when desired for employment in AN and other Army bombs. This adapter booster, the M117, has an inside thread diameter of 1.5 inches to receive the smaller fuzes and an outside thread diameter of

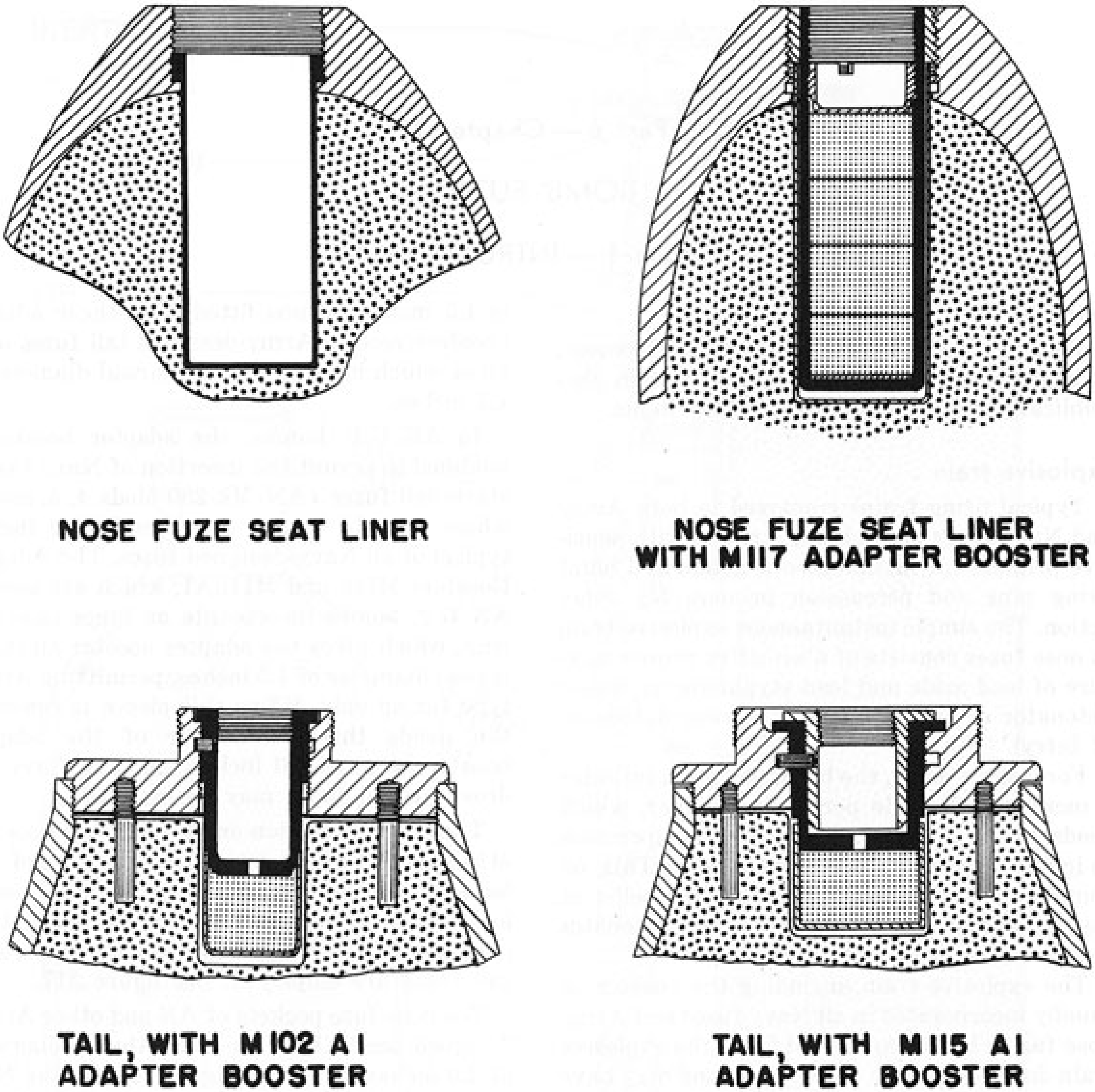


Figure 317. Army Fuze Seat Liners and Adapter Boosters

2.0 inches to fit the fuze seat liner. It converts the nose fuse pockets of G.P., S.A.P., L.C., 260-pound fragmentation, 90-pound fragmentation, 500-pound incendiary, and 500-, 1,000-, and 2,000-pound chemical bombs for use with the Nose Fuze M127.

The function of the Army adapter booster is performed in Navy bombs by the fuze seat liner and the auxiliary booster. The fuze seat liner is an integral part of the bomb, and the auxiliary booster is slipped into position as shown in figure 318. The Auxiliary Booster Mk 1 is used in the fuze seat liners of all Navy G.P., A.P., and depth bombs. One extra Auxiliary Booster Mk 1 is required to adapt the standard Navy nose fuze seat liner for the Fuze AN–Mk 219. The Auxiliary Booster Mk 2, which is designed pri-

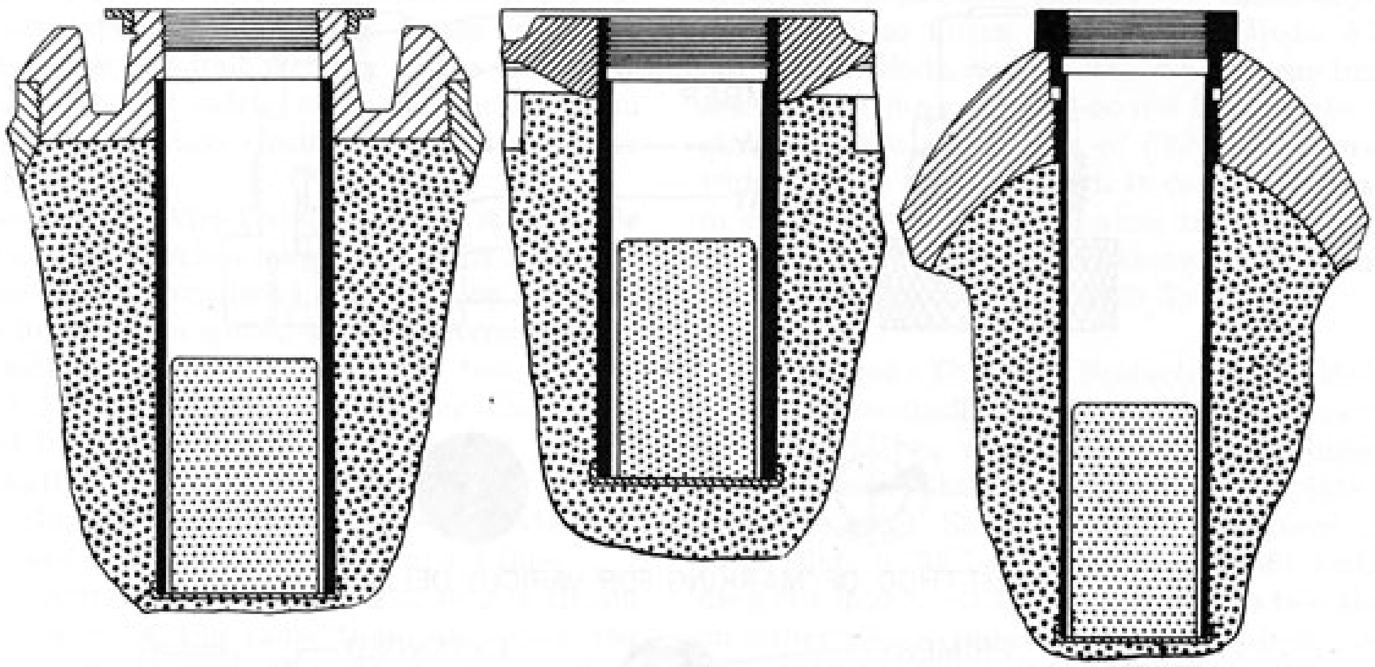


Figure 318. Navy Fuze Seat Liners

marily for insertion in rocket heads, can be adapted for Navy G.P. and depth bombs fuzed with the Tail Hydrostatic Fuze AN–Mk 230 by fitting a ¼-inch wooden disc spacer on the bottom of the fuze seat liner and placing two Auxiliary Boosters Mk 2 above the spacer. When it is desired to use the Nose Impact Fuze AN–Mk 219 in Army bombs, the Auxiliary Booster Mk 4 is inserted in the fuze seat liner.

Fuze Extension M1

The Fuze Extension M1 may be used in any bomb adapted for the Nose Fuze AN–M103. It comes in 6-, 9-, 12-, 18-, 24-, 30-, and 36-inch sizes, and consists of a burster support and a burster assembly. The burster support is a steel tube, 2.375 inches in outside diameter, which has a male thread at one end and a female thread at the other. The former screws into the adapter in the nose of the bomb; the latter receives the Nose Fuze AN–M103. The burster assembly consists of an asphalt-impregnated chipboard tube which has a recessed metal cap crimped to one end and a plain metal cap cemented to the other. The tube is filled with cast tetrytol. A shakeproof lock washer is supplied with each assembly.

Arming wires

The Navy is now procuring four standard arming wires for all bombs now in naval use, replacing the varied types previously in service. They will fit any bomb up to and including 2,000-pounds; and, by adding an arming-wire extension which is part of the new system, can be used in bombs up to 4,000 pounds.

The new wires come straight and are packed in hermetically sealed metal tubes, protecting them from corrosion. Depending on type, the tubes contain from 50 to 100 wires, including their clips and extra clips. The wires are cut, when installed, to fit the bomb.

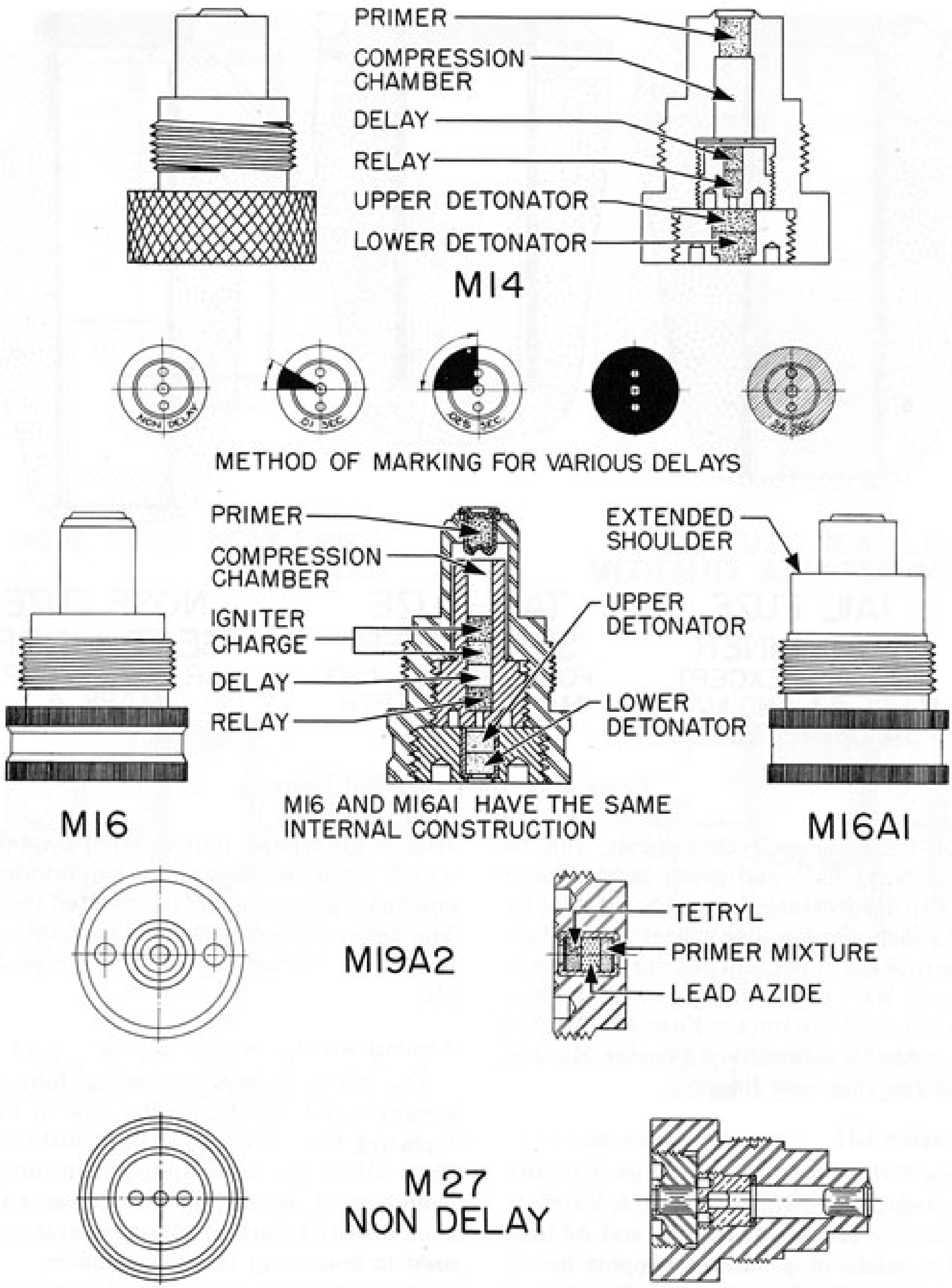


Figure 319. Some Primer Detonators

The Arming Wire Mk 1 is a single-strand bronze wire, 57 inches long and 0.064 inches in diameter, joined to a swivel and loop. This assembly can be used on all bombs expended with a single fuze, up to and including 2,000-pound bombs. The Bureau of Ordnance recommends

using two of these Mark 1 assemblies to rig out the athwartship hydrostatic fuzes of depth bombs. One hundred Arming Wires Mk 1, together with 300 safety clips, are packed in an airtight metal tube (includes an extra clip for each wire).

The Arming Wire Extension Mk 1 is a flexible steel cable 16 inches long and 0.0625 inches in diameter. It incorporates a swivel loop arrangement and a brass spring clip. The Arming Wire Extension Mk 1 may be used with two Arming Wires Mk 1 to install arming for the 4,000-pound light-case bomb. In addition, it is used to lengthen wires on fragmentation or incendiary clusters. One hundred of these extension wires are packed in an airtight metal tube.

The Arming Wire Mk 2 is a double-strand bronze wire of the same type, diameter, and length as the Arming Wire Mk 1. It is used on all bombs expended with a nose and tail fuze, up to and including 2,000-pound bombs. Fifty Wires Mk 2, together with 300 safety clips, are packed in an airtight metal tube.

The Arming Wire Mk 3 is a single-strand steel wire 57 inches long and 0.033 inches in diameter. The Arming Wire Mk 3 can be used anywhere the 0.036-inch diameter Navy-type wire was used, and in addition can be used in all jump-out-pin type Fuzes M111A2 in which a stronger wire is needed. One hundred Arming Wires Mk 3, together with 100 safety clips, are packed in an airtight metal tube.

The new standard assemblies do not replace special assemblies on any clusters, either fragmentation or incendiary, but the Wire Extension Mk 1 is used with such clusters so that their wires, which are too short for proper fitting, can be connected.

Arming wires are subjected to considerable wear from vibration. For that reason, tubes are supplied to protect a wire at its point of maximum wear. Use of these tubes on all bombs equipped with arming-wire brackets is mandatory. All old AN-type arming wires on hand and pre-cut to length for a bomb should be returned to the Army.

Fuze Protector Mk I Mod 0

General: The Fuze Protector Mk 1 Mod 0 is designed to prevent damage by the catapult bridle to Nose Fuzes AN–M103, all Mods, AN–Mk 219, all Mods, and Mk 243, when these fuzes are in 500-pound or 1,000-pound G.P. bombs installed on the wing racks of F6F-type aircraft which are to be catapulted. It can also be used in connection with mechanical time fuzes and the modified case-locking bushing for Fragmentation Clusters M28 and M29 Type.

Description: The Fuze Protector Mk 1 Mod 0 consists essentially of two pieces of 16-gauge steel five inches wide, bent into semicylinders of seven-inch diameter and one center plate of 16-gauge steel. Each semicylindrical piece has three slots 0.562 inches wide and 1.562 inches deep cut into it. At the bottom of the two slots on either side of the center slot, a ½-inch piece of metal is bent inward to form a stop. When installed, the two semicylindrical pieces are joined together by hinges (arming wires act as hinge pins) to form a cylinder.

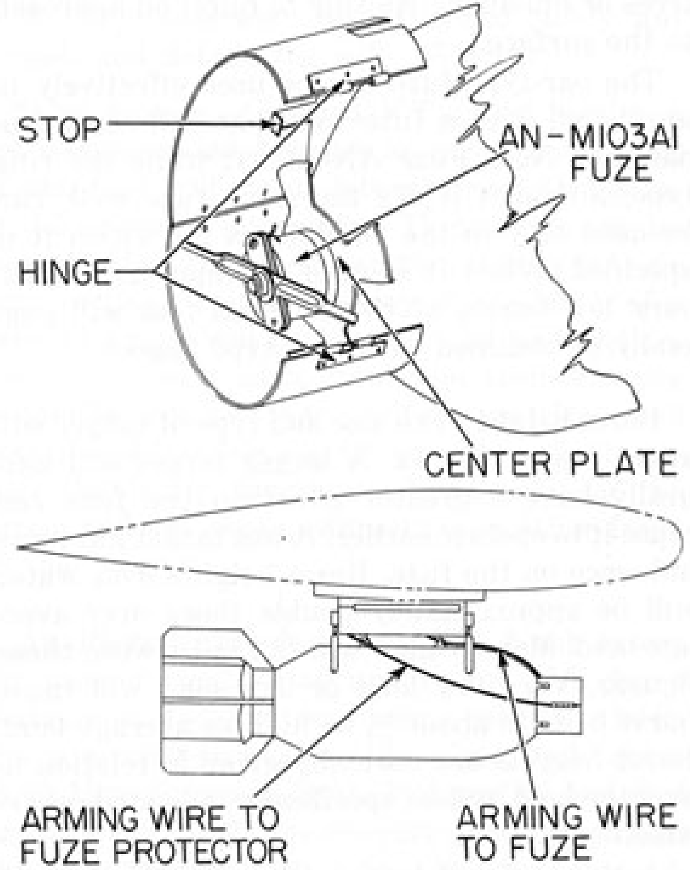


Figure 320. Fuze Protector Mk 1 Mod 0

Operation: The protector remains in place until the bomb is released. The arming wires are then pulled from the piano hinges of the protector. The two semicylindrical pieces then fall away from the bomb. The center plate remains in place between the fuze and the bomb.

V.T. bomb fuzes

Two types of V.T. bomb fuzes are in use: the ring type and the bar type. They are similar in operation, but somewhat different in behavior. The ring type is more sensitive to passing targets and generally gives lower bursts upon direct frontal approach to a target. The bar type is quite sensitive to targets directly in front of it and correspondingly less sensitive to passing targets. This gives the possibility of selecting a fuze to give burst heights where desired for a specific target. The ring is excellent for defoliating trees, because it is more sensitive to tree tops; it is also good for roof top bursts against tall city buildings. The bar type gives higher bursts over flat ground and tends to pass tall trees or buildings, waiting to burst on approach to the surface.

The bar-type fuze can be used effectively in any bomb with a fuze well that will accommodate the Nose Fuze AN–M103; while the ring type, although it fits the same fuze well, can be used only in the bomb sizes for which it is specified. When it is used in improper bombs, very low bursts of three to ten feet will generally be obtained with ring-type fuzes.

Burst height: The size and type of target will affect burst heights. A larger target will naturally have a greater effect on the fuze and cause it to operate earlier. A wet target has more influence on the fuze. Burst heights over water will be approximately double those over average land. Marshy land will fall in between these figures. Very dry land or dry sand will cause burst heights about ⅔ as high as average land. Burst heights are normally given in relation to average land, unless specifically indicated otherwise.

A mass of tall trees or large buildings will increase burst heights over land in their vicinity, but the increase in burst height will be somewhat less than the height of the objects, the degree of influence being dependent on the density of the object.

The size of the bomb in which the fuze is used will vary burst heights widely, but in no predictable pattern. Burst heights are tabulated for various bomb sizes with different V.T. fuzes, and the tables must be followed in predicting burst heights.

The height of release and air speed at time of release affect burst heights by controlling the rate and angle of approach of the fuze to the target. In general, the ring-type fuzes are influenced by angle and rate of approach, while the bar-type fuzes are rather insensitive to these differences. Bursts with ring-type fuzes are generally lower as the angle of approach nears the vertical. However, burst heights of ring-type fuzes increase with approach speed up to a certain point. By balancing these factors of approach speed and approach angle, fairly constant burst heights have been obtained for straight bombing at altitudes of less than 10,000 feet. At altitudes of release above 10,000 feet, burst heights are reduced somewhat. However, for any given altitude of release on level bombing runs, bursts will be higher with greater plane speeds when using ring-type fuzes, because the approach angle will be less vertical.

The air travel necessary to cause a V.T. bomb fuze to arm is designated as S.A.T. (safe air travel). Min. S.A.T., the minimum safe air travel, of any fuze in a lot is stencilled as part of the ordnance nomenclature on each fuze of the lot. No fuze will arm at less air travel in any bomb than the figure specified as Min. S.A.T. on the fuze. These figures of Min. S.A.T. are obtained from test droppings of representative samples of the lot in 100-pound bombs. All fuzes of the lot will be armed in a spread of 600 feet after Min. S.A.T. That is, if a Min. S.A.T. of 3,600 feet were specified on a lot of fuzes, none would be armed at 3,600 feet of air travel, and they would all be armed at 4,200 feet. Min. S.A.T. will be longer for larger bomb sizes, because of reduced air-stream velocity over the vanes. These increases are as follows for various bomb sizes: 260-pound AN–M81, 3%; 250-pound AN–M57, 12%; 500-pound AN–M64,

Figure 321. Air Travel Arming Delay M1

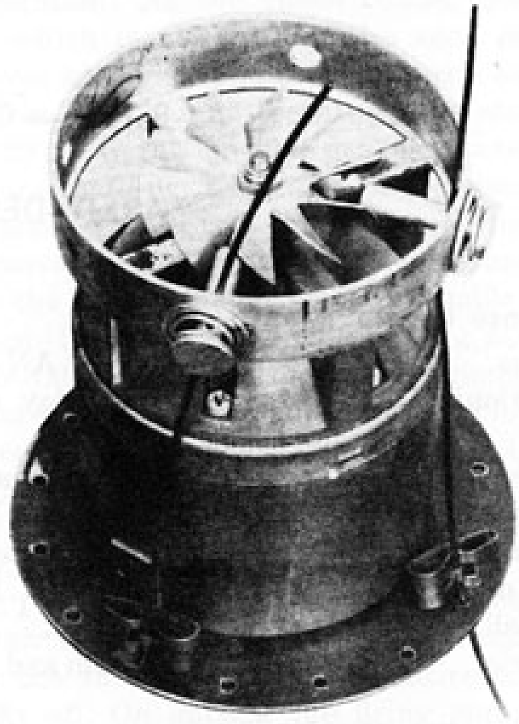


Figure 322. Auxiliary Safety Device for V.T. Bomb Fuzes

24%; 1,000-pound AN–M65, 33%; 2,000-pound AN–M66, 43%.

Under certain conditions, it is desirable to delay the arming of V.T. fuzes longer than the Min. S.A.T. provided in the fuze. When planes are flying in stack formation with other units of the formation flying 2,000 feet or more below, or with a large fighter cover working below, if the fuzes were armed in the normal time and passed near the lower friendly aircraft, influence bursts would occur, causing casualties to friendly craft. To prevent this, **mechanical arming delays** for attachment to these fuzes have been developed. These Air Travel Arming Delays M1 are so installed that they prevent the spring-loaded arming pin from releasing the fuze vanes for a pre-set air travel distance.

The start of fuze arming may be delayed by use of this device through air travel distances up to 20,000 feet.

These fuzes are not to be partially pre-armed by turning the vanes to make possible use from lower release altitudes. Casualties to the carrying aircraft will usually result. Bombs fuzed with V.T. fuzes may be jettisoned safely unarmed, and detonation will not occur.

Salvo release of armed V.T.-fuzed bombs is not recommended, because an early functioning of one fuze will cause detonation of all bombs of the group by interaction. These fuzes are designed to function upon a sudden change in their surroundings, and detonation of one bomb of a salvoed group will cause them all to function. For the same reason, minimum train spacing should be greater than 50 feet for 100-pound bombs and 100 feet for 500-pound bombs to assure that early functions of one bomb of the group will not cause interaction on other fuzes of the "stick."

Auxiliary safety device for V.T. bomb fuzes: To prevent accidental arming of V.T.-fuzed bombs mounted on exposed wing racks, the additional arming wire assembly, plate, and fahnestock clips shown in figure 322 may be installed on the Fuze M168. For aircraft to be catapulted, the Fuze Protector Mk 1 Mod 0 is used instead, since this device protects the fuze and also secures the arming wires.

ARMY–DESIGNED BOMB FUZES

M1 (Nose Inertia Type)

Bombs.........6-pound Incendiary AN–M69
Functioning....3 to 5 seconds delay after impact
Armed condition......Safety plunger is out.
Fuzes used with.....................None
Arming time................Instantaneous
Body diameter, inches................1.125
Over-all length, inches..................2.5
Material........Die-cast aluminum and steel

General: The Nose Fuze M1 is screwed into the side of the nose of the Bomb AN–M69. When assembled, the two arrows on the top of the fuze case must be parallel to the longitudinal centerline and point aft. This is necessary in order that the fuze will fire on nose impact. The fuze consists of five main parts; namely, a die-cast aluminum fuze base, a striker of the same material, a primer cap, a lead-coated spitter fuse (60% black powder — 40% collodion) and a booster charge consisting of 1.2 grams of black powder. The booster cup is a transparent nitro-cellulose composition. The entire fuze assembly is contained in a cover of steel tubing. A safety plunger prevents the striker from detonating the primer cap while the bomb is clustered.

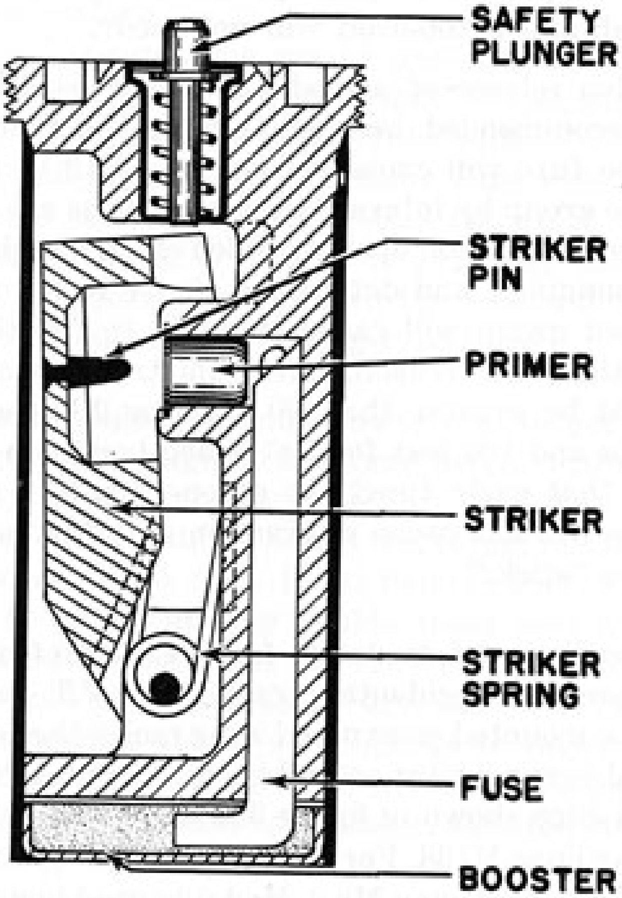


Figure 323. Nose Inertia Fuze M1

Operation: Upon release from the cluster, the spring-operated fuze safety plunger in each bomb moves outward, thereby arming the fuze. Upon impact, the momentum of the striker carries it forward and causes the striker pin to detonate the primer cap, which, in turn, ignites the lead-coated spitter fuse. The latter requires from three to five seconds to burn. The spitter fuse ignites the booster charge of black powder contained in a celluloid cup in the end of the fuze case. This ignites the igniter-ejector charge of black powder and oiled magnesium powder in the nose cup of the bomb.

Remarks: See figure 306, Bomb AN–M69, showing the Fuze M1 assembled in the bomb.

AN–M100A2, AN–M101A2, AN–M102A2 (Tail Mechanical Impact) and (Obsolete) M100 and AN–M100A1 Series

Bombs used in
AN–M100A2....100-lb. G.P. AN–M30
250-lb. G.P. AN–M57
220-lb. Frag. AN–M88
260-lb. Frag. M81

AN–M101A2	500-lb. G.P. AN–M43 500-lb. G.P. AN–M64 500-lb. S.A.P. AN–M58 500-lb. Incend. AN–M76 500-lb. Chem. AN–M78 600-lb. G.P. M32
AN–M102A2	1,000-lb. G.P. AN–M44 1,000-lb. G.P. AN–M65 1,000-lb. S.A.P. AN–M59 1,000-lb. Chem. AN–M79 1,100-lb. G.P. M33 2,000-lb. G.P. AN–M34 2,000-lb. G.P. AN–M66 2,000-lb. S.A.P. M103 4,000-lb. L.C. AN–M56
Functioning	Interchangeable Primer Detonator M14 with delays of 0.01, 0.025, 0.1, or 0.24 second or non-delay
Armed condition	When gear carrier stop protrudes less than 1 inch below vane cup
Fuzes used with	AN–M103 normally, M139, AN–M139, M140, AN–M140A1, M163, M164, M165, M135, M135A1, M136, M136A1, M166, Mk 243, T50E1, T50E4, T82, M168

Arming data

	Vane Revs.	Air Travel (feet)	Minimum Vertical Drop (feet)
AN–M100A2	150-170	445-485	40-50
AN–M101A2	150-170	555	60-70
AN–M102A2	150-170	465-665	85

Vane span, inches	5 (4 vanes)
Body diameter, inches	1.5
Over-all length, inches	AN–M100A2— 9.6 AN–M101A2—12.6 AN–M102A2—16.6
Material	Cadmium plated steel with some brass parts

General: These three fuzes are identical except for the length of the arming stem. Larger bombs require a longer arming stem, so that the vanes can catch the air slip from the bomb.

Operation: As the vanes rotate, the pinion gear which is attached to the vane assembly revolves around the stationary gear. Since the movable gear has 30 teeth and the stationary gear 29 teeth, the movable gear is rotated clockwise one tooth per revolution of the pinion gear. The arming stem is secured by a cotter pin to the movable-gear sleeve, and hence unthreads from the firing plunger as the movable gear is rotated. In unthreading, the arming stem lifts the movable gear, and, since the stationary gear is held by a collar threading into the lower extension of the movable gear sleeve, the stationary gear is lifted also. After 150 to 170 revolutions of the vanes, the double-threaded arming stem will have unthreaded from the firing plunger and the fuze will be armed. Further air travel will unthread the arming stem from the fuze body, and the entire assembly will fly off. On impact, the firing plunger will overcome the creep spring, and the striker will activate the primer detonator.

Early designs: The M100, M101, and M102 fuzes had a fixed delay of 0.1 second, and had 24 single threads on the arming stem. They had eight broad vanes with less pitch, and required approximately 720 vane revolutions to arm. AN–M100A1, AN–M101A1, and AN–M102A1 incorporated the interchangeable Primer Detonator M14. The A2 modification then reduced the number of vanes to four, and the number of threads to 16 double threads, thus decreasing the arming time to approximately 150 to 170 vane revolutions.

Remarks: When these fuzes are used in the 260-pound Frag., 500-pound Incendiary, 500-pound, 1,000-pound, and 2,000-pound Chem., and 4,000-pound L.C. bombs, the Primer Detonator M14 should have non-delay functioning. On G.P. and S.A.P. bombs, the length of the short delay will be governed by the tactical use. The 0.24-second delay primer detonator was developed for these fuzes for use in connection with the Nose Fuze Mk 243. Fuzes equipped with this primer detonator will function at a depth of 25 feet and are more accurate than the Tail Hydrostatic Fuze AN–Mk 230, especially on high-velocity impact.

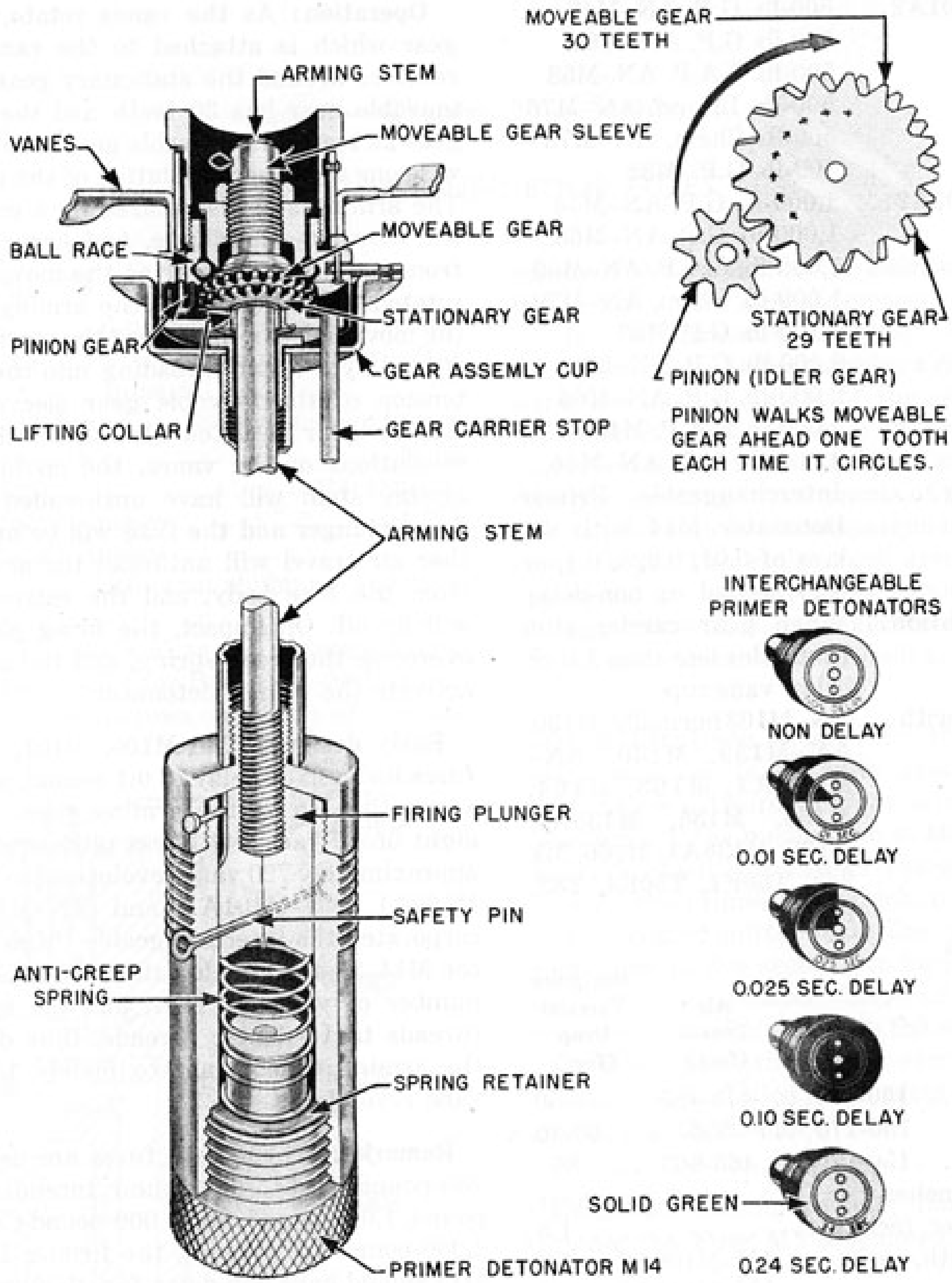


Figure 324. Tail Fuzes AN–M100 and M160 Series

M160, M161, M162 AN–M100A2C, and AN–M101A2C (Tail Mechanical Impact)

Bombs

M160	100-lb. G.P. AN–M30
	250-lb. G.P. AN–M57
	220-lb. Frag. AN–M88
	260-lb. Frag. M81
M161	500-lb. G.P. AN–M64 (AN–M43)
	500-lb. S.A.P. AN–M58
	500-lb. Incend. AN–M76
	500-lb. Chem. AN–M78
	600-lb. G.P. M32
M162	1,000-lb. G.P. AN–M65 (AN–M44)
	1,000-lb. S.A.P. AN–M59

1,000-lb. Chem. AN–M79
1,100-lb. G.P. M33
2,000-lb. G.P. AN–M66 (A1, A2)
2,000-lb. S.A.P. M103
4,000-lb. L.C. AN–M56

Functioning.....Primer Detonator M14 with delays of 0.01, 0.025, 0.1 and 0.24 seconds and non-delay

Armed condition.....When gear carrier stop protrudes less than one inch below vane cup

Fuzes used with....M163, M164, M165 normally, AN–M103A1, AN–M103, M139, M139A1, AN–M139A1, M140, M140A1, AN–M140A1, Mk 243

Arming data

	Vane Revs.	Air Travel (feet)	Minimum Vertical Drop at 200 m.p.h. (feet)
M160	720	1,780-1,950	650
M161	720	1,910-2,230	805
M162	720	1,710-2,680	1,130

Vane span, inches............5 (four vanes)
Body diameter, inches..................1.5
Over-all length, inches..........M160— 9.6
M161—12.6
M162—16.6
Material.............Cadmium-plated steel; some brass parts

General: The Mechanical Impact Tail Fuzes M160, M161, and M162 are similar to the AN–M100A2, and AN–M102A2 respectively, except for the arming stem, which has finer threads (28 single threads to the inch against 20 double threads in the AN–M100 series) and a longer engagement with the firing plunger (0.75-inch against 0.50-inch). The M160 series fuzes are distinguished externally from the AN–M100 group by a yellow band three inches wide painted around the arming-stem case.

The slower arming is desired in order to prevent the premature explosion of bombs within the range of releasing aircraft. This has been caused in the past by bombs bumping each other after being dropped in clusters or in salvo at high altitudes by very heavy bombers. In addition, the bomb bays of the B-29's are subjected to considerable air turbulence, distorting the fall of the bombs, thereby increasing the hazard of premature explosion and dictating the need for slower arming.

Operation: The operation is similar to the fuzes of the AN–M100 series, except for the incorporation of a longer arming time in the M160 series.

Remarks: When these fuzes are used in the 260-pound Frag. Bombs M81, the 220-pound Frag. Bombs AN–M88, the 500-pound Incendiary Bombs AN–M76, the 500-pound Chemical Bombs AN–M78, the 1,000-pound Chemical Bombs AN–M79, and the 4,000-pound L.C. Bombs AN–M56, the Primer Detonator M14 should have non-delay functioning.

The first of the slower-arming tail fuzes produced were designated as the AN–M100A2C series. These have the same number of threads per inch as the M160 series, but have the shorter engagement of the AN–M100 series fuzes. The yellow band is painted on, as in the M160 series fuzes.

AN–M103 (Obsolescent) and M103 (Obsolete) (Nose Mechanical Impact)

Bombs....All G.P. bombs except Mk 4 Mod 4. The depth bombs for land targets, Chemical, Frag., and Incendiary bombs. May be used in S.A.P. for fragmentation effect, but result is not too consistent.

Functioning.....Instantaneous or 0.1-second delay alternative settings

Armed condition...When safety discs are out

Fuzes used with......AN–M100 series (normally)

Arming time.....Instantaneous setting, 330 vane revolutions; 0.1 sec. delay setting, 220 vane revolutions

Vane span, inches..............6 (2 vanes)
Body diameter, inches..................2.7
Over-all length, inches....................7
Material.............Cadmium-plated steel; some brass parts

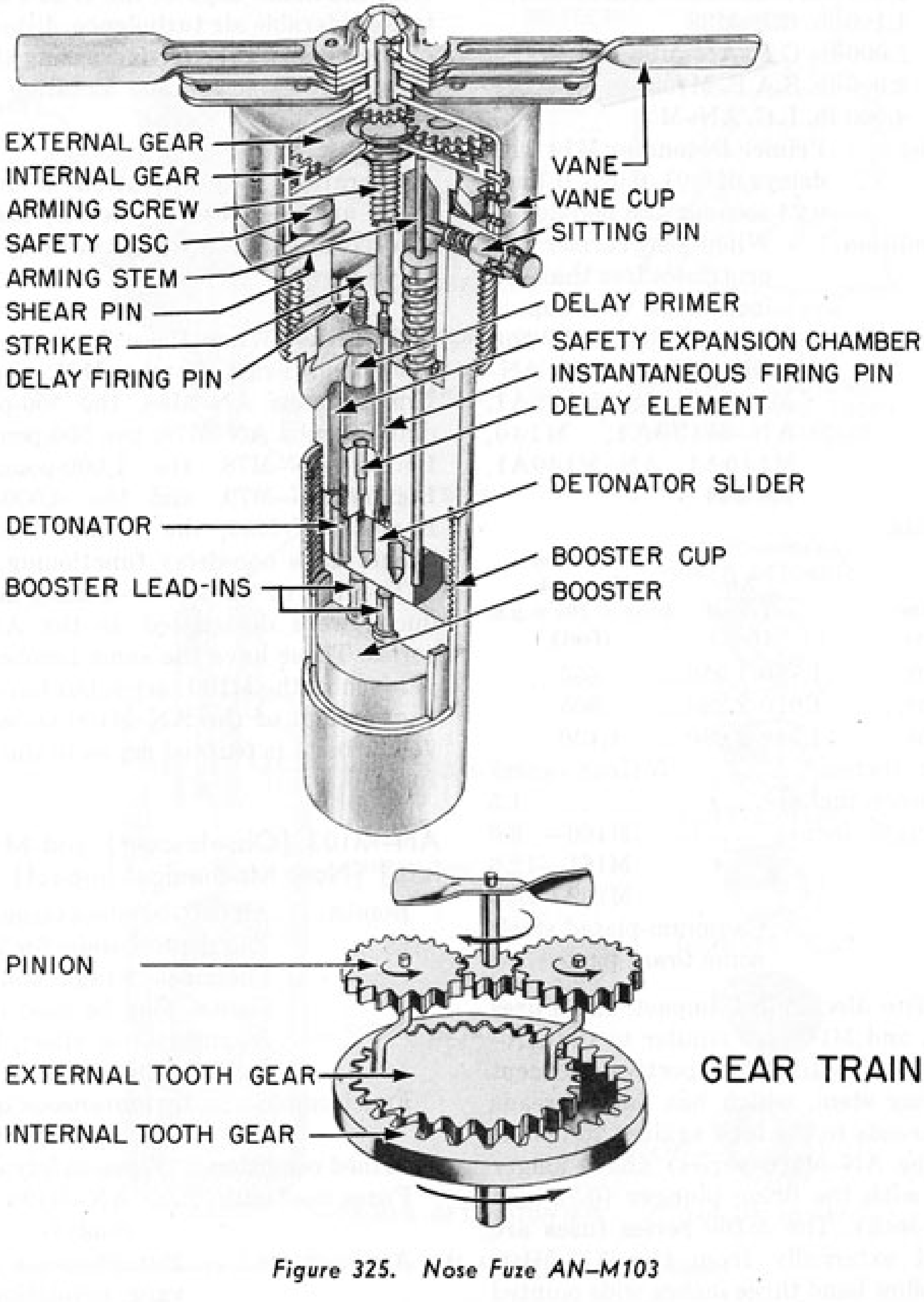


Figure 325. Nose Fuze AN–M103

General: The AN–M103 was the standard nose fuze in service. When shipped, the fuze is set for delay action. One auxiliary booster is required when this fuze is used in Navy bombs. When used in light-case, fragmentation, chemical, incendiary, and aircraft depth bombs, the fuze should be set for instantaneous action to prevent breaking up of the bomb case before detonation occurs.

Operation: When bomb is dropped, the arming wire is pulled and the vanes rotate. The two pinion gears are rotated counterclockwise, their off-center hubs walking the external-tooth gear

backwards around the teeth of the internal-tooth gear, which is thus cranked in a counterclockwise direction. The outboard edge of the internal-tooth gear is grooved and rides screws projecting through from the vane cup, maintaining an even position. The arming screw, being positively attached to the base of the internal-tooth gear, is gradually unthreaded from the striker. As it unthreads, it lifts the entire vane assembly, including the vane cup. After 220 revolutions of the vanes, the vane cup will clear the safety discs, which spring free, leaving the striker secured only by the shear wire and the setting pin. The spring-loaded arming stem will rise as the vane assembly rises, being retained only by the base of the internal-tooth gear. If the setting is for delay action, however, the setting pin will be depressed into the deep slot and will protrude into the channel of the arming stem to engage the collar on the arming stem after it has risen only sufficiently to clear the step in the detonator slider, lining the detonator up with the delay firing train.

On impact, the force of inertia will cause the striker body to shear the shear pin and setting pin, and the delay firing pin will impinge on the delay primer, setting off the flash which ignites the delay pellet, relay, primer, detonator, booster lead-in, and booster in succession. The instantaneous firing pin will merely protrude into the empty channel positioned to receive it. If the fuze is set for instantaneous action, the setting pin will be in the shallow slot and will not protrude into the arming-stem channel. After an additional 110 revolutions of the vanes (330 total), the vane cup will have been lifted high enough to have the arming stem moved out of the slider cavity, allowing the slider to align the primer detonator beneath the instantaneous firing pin. The slider is motivated by two springs and is locked in the armed position by a spring-loaded detent. On impact, the firing pin will impinge directly on the primer, setting off the detonator, booster lead-in, and booster in succession. Even though an instantaneous setting is used, the delay striker will impinge on the delay primer, setting off the delay pellet. It is thus possible that the fuze would function on delay, even though set for instantaneous action, if it failed to function instantaneously.

Early design: The Nose Mechanical Impact Fuze M103 had 32 single threads per inch on the arming screw, instead of 28 double threads per inch on the AN-M103, resulting in an arming time of 850 vane revolutions for instantaneous firing and 525 vane revolutions when set for delay action. The M103 had larger and weaker vane construction.

Remarks: Especially large vanes have been designed for the AN-M103 for use with flat-nosed depth bombs, as the regular vanes have difficulty in arming.

The AN-M103 can be used for dive bombing, but not for masthead bombing.

AN-M103A1 (Nose Mechanical Impact)

General: The Nose Mechanical Impact Fuze AN-M103 is being replaced by the AN-M103A1, which differs in that the striker block has been drilled and tapped to accommodate an arming screw of a greater diameter. The hole for the arming screw joins that of the arming stem. In this way, it is possible for the collar on the arming stem, under pressure of the arming-stem spring, to bear against the base of the widened arming screw. In the earlier production of the AN-M103A1, a threaded sleeve was fitted and staked to the original arming screw of the AN-M103 to form the new widened arming screw. In the later productions, the widened arming screw is a single solid piece. In other respects, the AN-M103 and AN-M103A1 are similar.

The purpose of modifying the Nose Mechanical Impact Fuze AN-M103 as described above is to eliminate the possibility of accidental detonation in crash landings, and thus make it safe for carrier usage. In some cases, during crash landings, upon initial impact, the vane cup and head of the AN-M103 were sheared off, allowing the arming stem to jump out, and the slider to align itself below the firing pin. On subsequent nose impact, the fuze fired. The AN-M103A1 increases the safety primarily because the arming stem cannot jump out on accidental shearing of the vane cup assembly, as the arming screw overlaps the arming-stem collar.

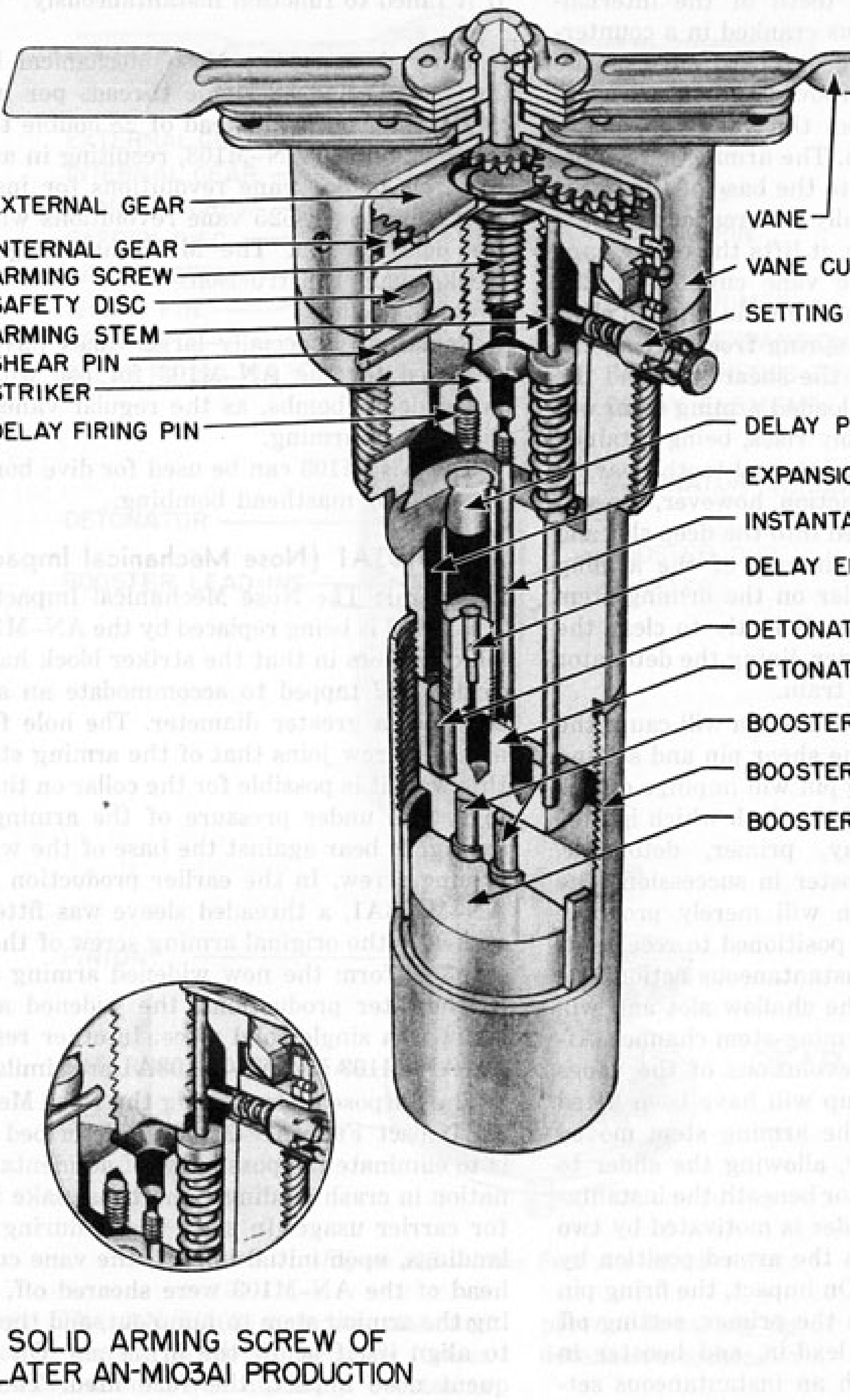


Figure 326. Nose Fuze AN–M103A1

Operation: The operation of the AN–M103A1 is the same as that of the AN–M103 except that, in the former, the arming stem, in addition to bearing against the internal gear, has its collar

bearing against the arming screw. As the arming screw moves out, the arming stem follows it until the arming-stem collar bears against the setting pin for delay action, or against the top of the cavity for instantaneous action. In a crash landing, if the vane cup and head of the fuze shear off, the arming stem is held in place by the arming screw; hence, the slider cannot move over and the fuze will not fire.

Remarks: Air travel to arm the AN–M103A1 is the same as the AN–M103, since the AN–M103 has 28 double threads per inch on the arming screw while the AN–M103A1 has 14 single threads per inch.

AN–M139A1, AN–M140A1, M139, and M140 (Nose Mechanical Impact)

Bombs used in..........All bombs receiving AN–M103A1

Functioning....M139, AN–M139A1 instantaneous or 0.01-second delay alternative settings. M140, AN–M140A1 instantaneous or 0.025-second delay alternative settings

General: The M139 and the M140 are identical in construction to the standard AN–M103, with the exception that the amount of the delay element has been changed to decrease the functioning delay time from 0.1 second (AN–M103) to 0.01 (M139) or 0.025 (M140). All these fuzes have the alternative instantaneous setting.

In order to distinguish these fuzes from the AN–M103, the vane cups have segments painted on them. One eighth of the vane cup of the M139, and one quarter of the vane cup of the M140 is painted black. These markings correspond with those on the Primer Detonator M14. The M139A1 and the M140A1 are the same as the M139 and M140 respectively, except that they incorporate the widened arming screw found in the AN–M103A1.

Operation: M139, M140—Same as AN–M103. AN–M139A1, AN–M140A1 — Same as AN–M103A1.

Remarks: The AN–M139A1 and AN–M140A1 are current production and replace the M139 and M140 respectively.

All these fuzes were developed as companion fuzes for the AN–M100A2 series, which uses the Primer Detonators M14 with delays of 0.01 second or 0.025 second.

M148 (Nose Mechanical Impact)

Bombs used in...........Captured Japanese navy bombs

Fuzes used with.......................None

Over-all length, inches..................9.3

General: The Nose Mechanical Impact Fuze M148 is the same as the AN–M103, except that the booster cup has been modified so as to have the contour of the standard Japanese Navy type gaine. In addition, the threads on the fuze body have been modified to fit Japanese navy bombs —1.84-inch, 10 Whitworth thread.

M163, M164, and M165 (Nose Mechanical Impact)

Functioning

M163........Instantaneous; 0.1-sec. delay

M164.......Instantaneous; 0.01-sec. delay

M165......Instantaneous; 0.025-sec. delay

Fuzes used with

M160, M161, or M162 normally; AN–M100A2 series

Arming data

	Inst.	Delay
Revolutions	750 (approx.)	500 (approx.)
Air travel	1,710-3,625 ft.	1,140-2,420 ft.
Minimum vertical drop at 200 m.p.h.	1,775 ft.	915 ft.

General: The Nose Mechanical Impact Fuzes M163, M164, and M165 correspond to the AN–M103A1, AN–M139A1, and AN–M140A1 respectively, except for the arming screw of the M163 series, which has 32 single threads per inch as against 14 single threads to the inch in the earlier fuzes. Although the length of the M163 arming screw is reduced to 0.5 inch, the crash-proof feature is retained in the new series by

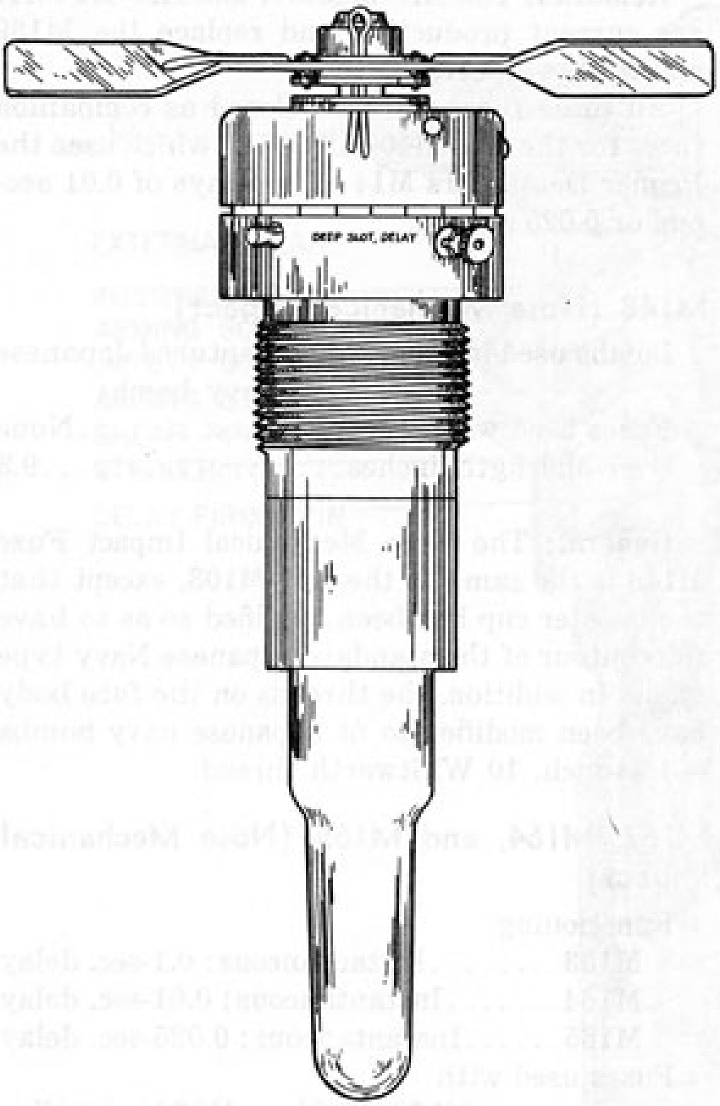


Figure 327. Nose Fuze M148

the addition of a second shoulder, higher up on the arming stem, which bears against the bottom of the arming screw.

This series of fuzes is designed as a companion group for the M160, M161, and M162; and serves to eliminate the difficulties discussed with reference to the M160 series.

To distinguish the new series from their prototypes, the following markings are employed: the top of the M163 vane cup is painted completely yellow; and, in the M164 and M165, the vane cup is painted yellow except for the black sections indicating the delays.

T32E1 and T33E1 (Nose Mechanical Impact)

Bombs............G.P. bombs which receive AN–M103 — Skip-bomb size

Functioning.......T32E1 — 4- to 5-second delay
T33E1—11- to 14-second delay

Armed condition..........Safety discs out

Fuzes used with.......M113, M113A1, M116

General: A nose fuze for minimum-altitude bombing, this design changes the Nose Mechanical Impact Fuze AN–M103 to give the necessary long delay. The T32 and T33 differ only in the amount of pyrotechnic delay. The delay feature is accomplished by drilling axially through the fuze body—two tubes for the powder train and a third for an expansion chamber. A larger axial hole houses the rotor containing the detonator, and provides detonator safety for this fuze. There is no instantaneous firing train.

Operation: Rotation of the vanes makes the arming spindle and the striker block move upward, with the assistance of the spring, until the safety discs are flung out by the leaf spring which is located inboard of them. As the arming spindle rises, it allows the rotor stem, which is spring-loaded downward, to turn the rotor, bringing the detonator in line with the lower end of the delay train. The fuze is now fully armed. On impact, the striker block is forced down, mashing the firing pin into the primer and setting off the delay powder train. The powder is in the two lower small tubes, and burns from the primer down to the detonator, in the rotor, then to the booster lead-in, and finally at the booster. The uppermost small tube is an expansion chamber, to prevent pressure from the burning delay powder from causing a malfunction.

AN–M104 (Obsolescent) and M109 (Obsolete) (Mechanical Impact)

Bombs....AN–M104—23-lb. Frag. AN–M40
M109—20-lb. Frag. AN–M41

Functioning ....Instantaneous

Armed condition.......When delayed arming disc is out

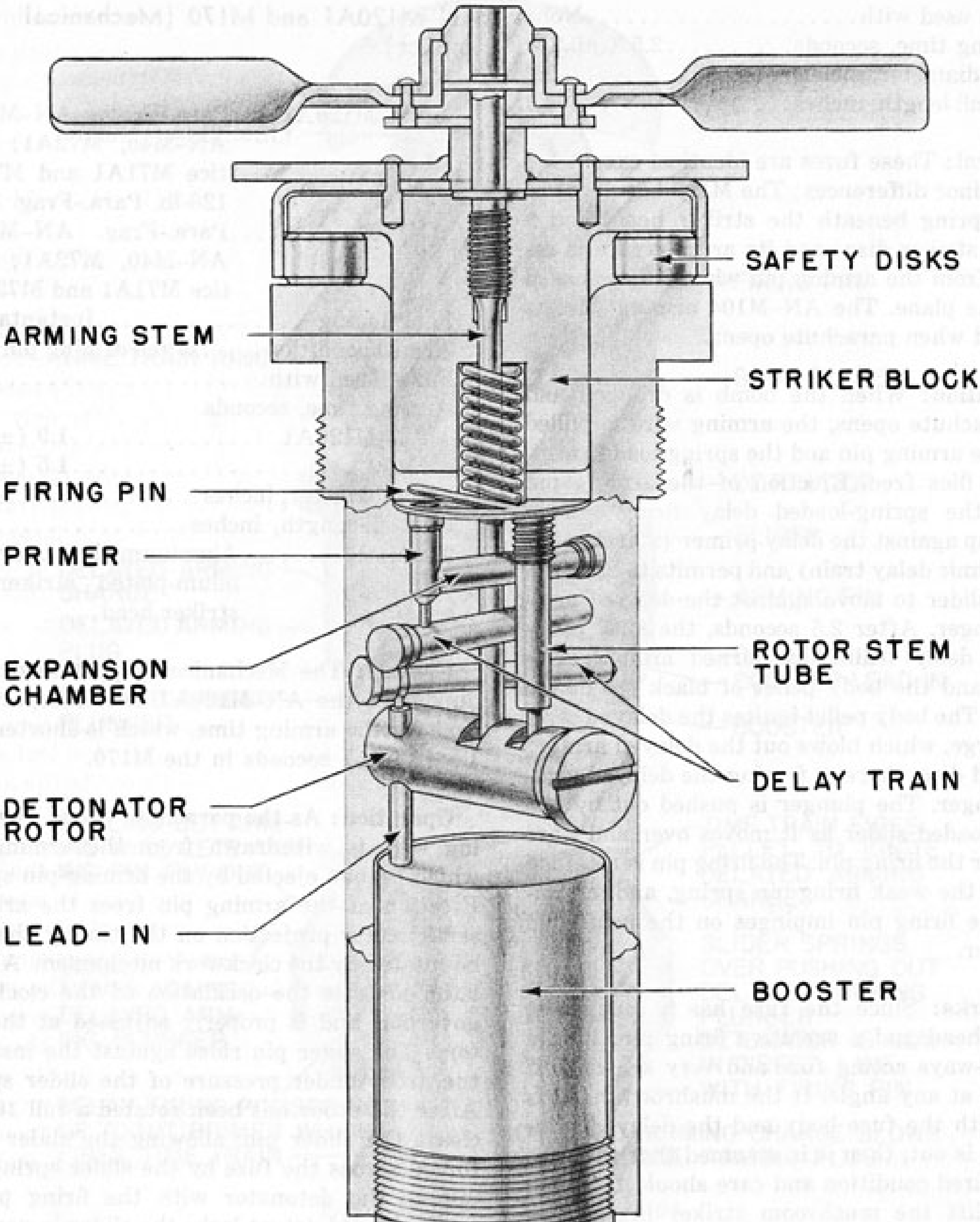


Figure 328. Nose Fuzes T32E1 and T33E1

Fuzes used with....................None
Arming time, seconds..........2.5 (±0.25)
Body diameter, inches..................2.2
Over-all length, inches..................4.4

General: These fuzes are identical except for three minor differences: The M109 has an additional spring beneath the striker head, and a smaller striker disc; and its arming wire is removed from the arming pin when it is released from the plane. The AN–M104 arming wire is removed when parachute opens.

Operation: When the bomb is dropped and the parachute opens, the arming wire is pulled from the arming pin and the spring-loaded arming pin flies free. Ejection of the arming pin allows the spring-loaded delay firing pin to spring up against the delay primer (starting the pyrotechnic delay train) and permits the spring-loaded slider to move against the delayed arming plunger. After 2.5 seconds, the 326° pyrotechnic delay train has burned around completely and the body pellet of black powder is ignited. The body pellet ignites the delayed arming charge, which blows out the delayed arming plug and disc, thereby freeing the delayed arming plunger. The plunger is pushed out by the spring-loaded slider as it moves over and lines up under the firing pin. The firing pin is retained only by the weak firing-pin spring, and, on impact, the firing pin impinges on the primer in the slider.

Remarks: Since the fuze has a mushroom striker head and a sensitive firing pin, it is a semi-all-ways acting fuze and very sensitive if touched at any angle. If the mushroom head is flush with the fuze body and the delayed arming disc is out, then it is assumed that the fuze is in a fired condition and care should be taken not to lift the mushroom striker head away from the fuze body.

The AN–M104 has been replaced by the AN–M120A1; and the M109, by the AN–M110A1.

AN–M120A1 and M170 (Mechanical Impact)

Bombs
AN–M120A1....Para.-Frag. AN–M40A1, AN–M40, M72A1; Practice M71A1 and M73A1; 120-lb. Para.-Frag. M86
M170 ....Para.-Frag. AN–M40A1, AN–M40, M72A1; Practice M71A1 and M73A1
Functioning ....Instantaneous
Armed condition.....When arming pin is out
Fuzes used with......................None
Arming time, seconds
AN–M120A1 ....1.9 (±0.15)
M170 ....1.5 (±0.15)
Body diameter, inches..................2.2
Over-all length, inches..................4.4
Material.........Aluminum alloy body; cadmium-plated striker and striker head

General: The Mechanical Impact Fuze M170 duplicates the AN–M120A1 in all respects except for the arming time, which is shortened to 1.5 (±0.15) seconds in the M170.

Operation: As the parachute opens, the arming wire is withdrawn from the arming pin, which is then ejected by the arming-pin spring. Ejection of the arming pin frees the arbor, a semicircular projection on the timing shaft, to be rotated by the clockwork mechanism. A regulator controls the oscillation of the clockwork governor, and is properly adjusted at the factory. The slider pin rides against the inside of the arbor under pressure of the slider spring. After the arbor has been rotated a full 160°, it clears the slider pin, allowing the slider to be forced across the fuze by the slider spring, lining up the detonator with the firing pin. A spring-loaded detent locks the slider in position. On impact, the striker head is forced in, driving the firing pin into the primer detonator and detonating the bomb.

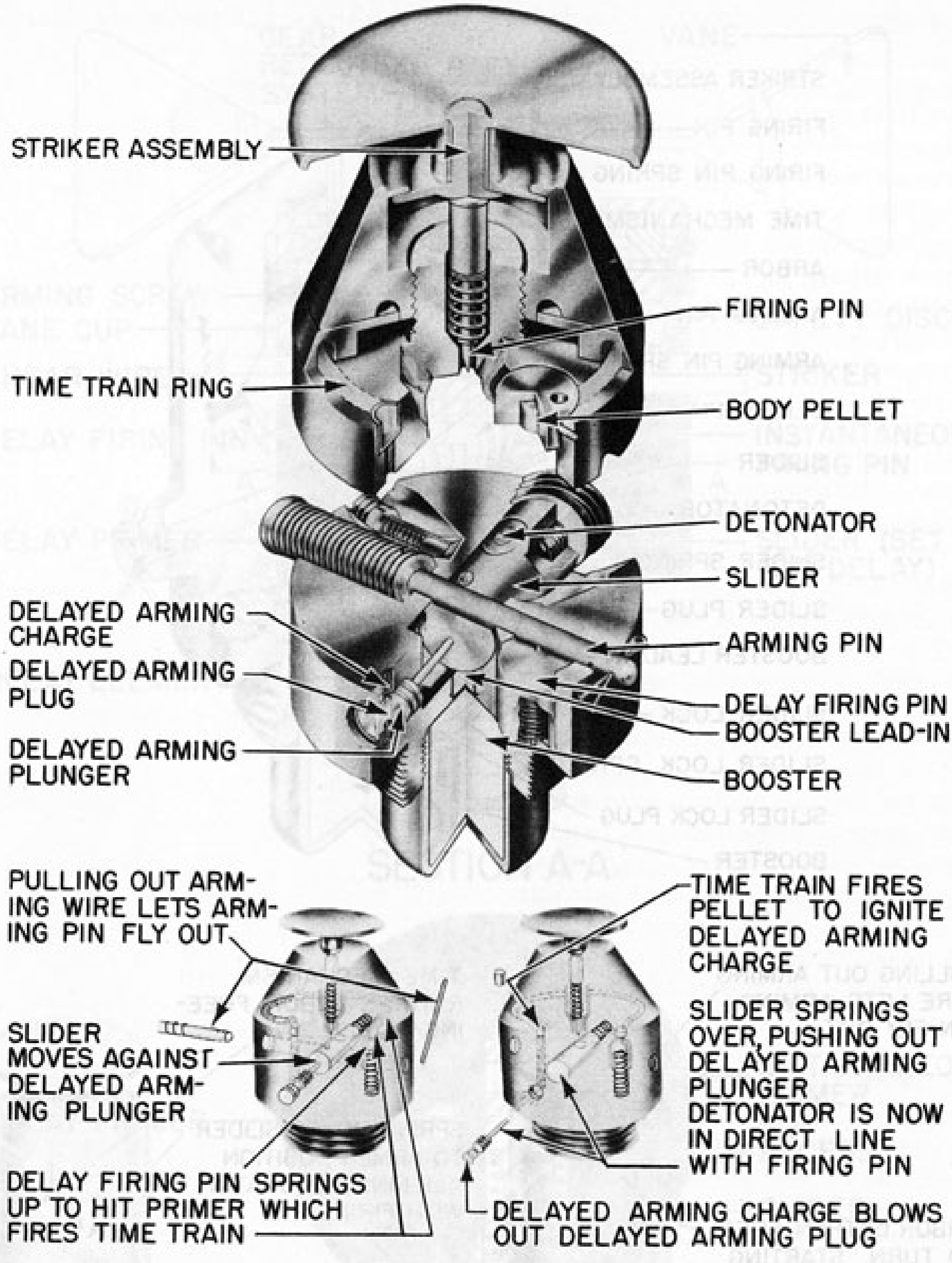


Figure 329. Nose Fuze AN-M104

Remarks: The M120 and AN-M120 did not have the clockwork regulator, and had an arming time of 2.5 ($\pm$0.25) seconds; hence, attacks had to be made at higher levels. External appearance of all designs is the same.

This fuze is replacing the AN-M104 in the parachute fragmentation bomb.

The M170 is designed to supplant the AN-M120A1 in all bombs receiving the AN-M120A1, except for the 120-pound Para.-Frag. Bomb M86, which will continue to use the older fuze.

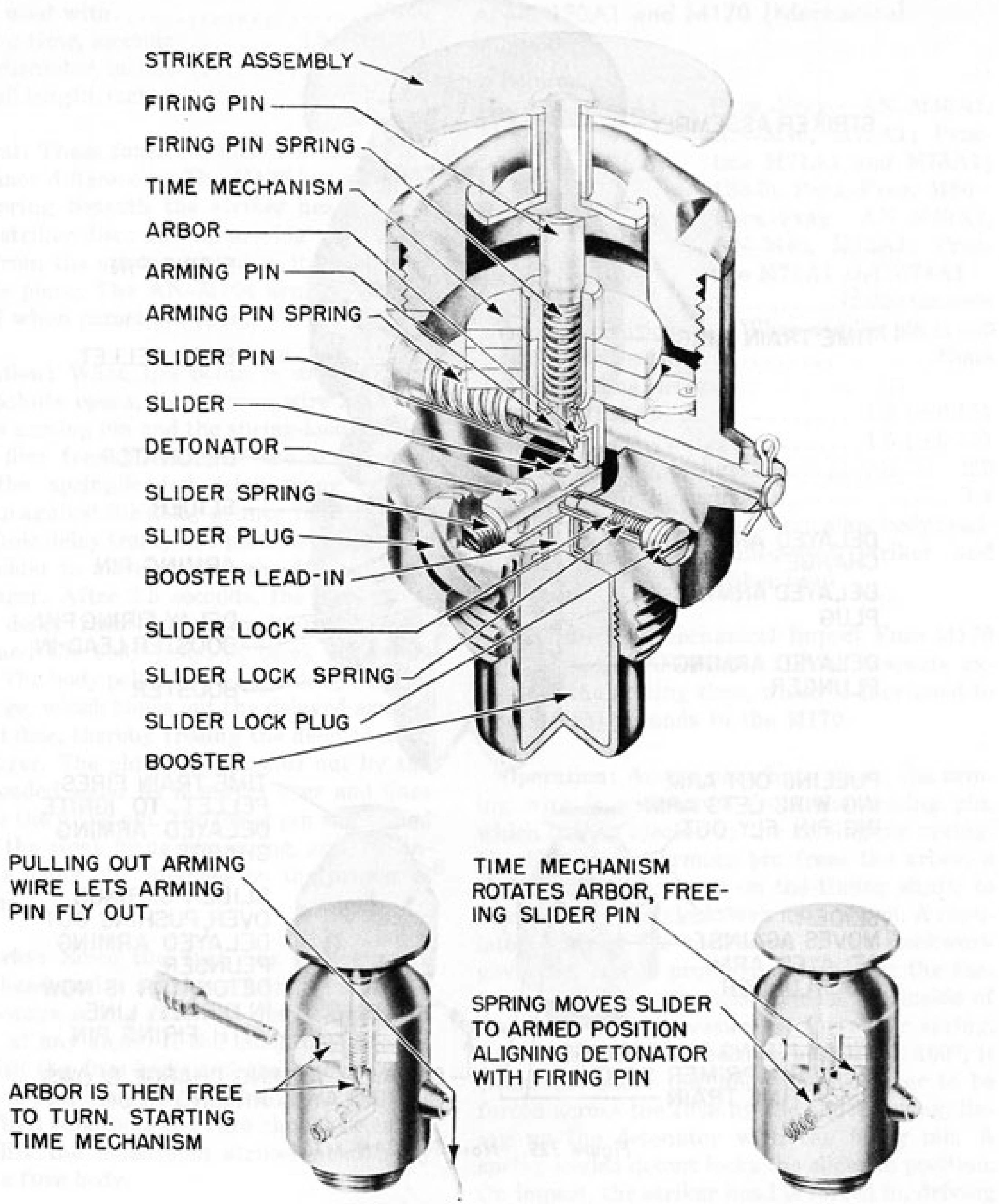


Figure 330. Nose Fuze AN–M120A1

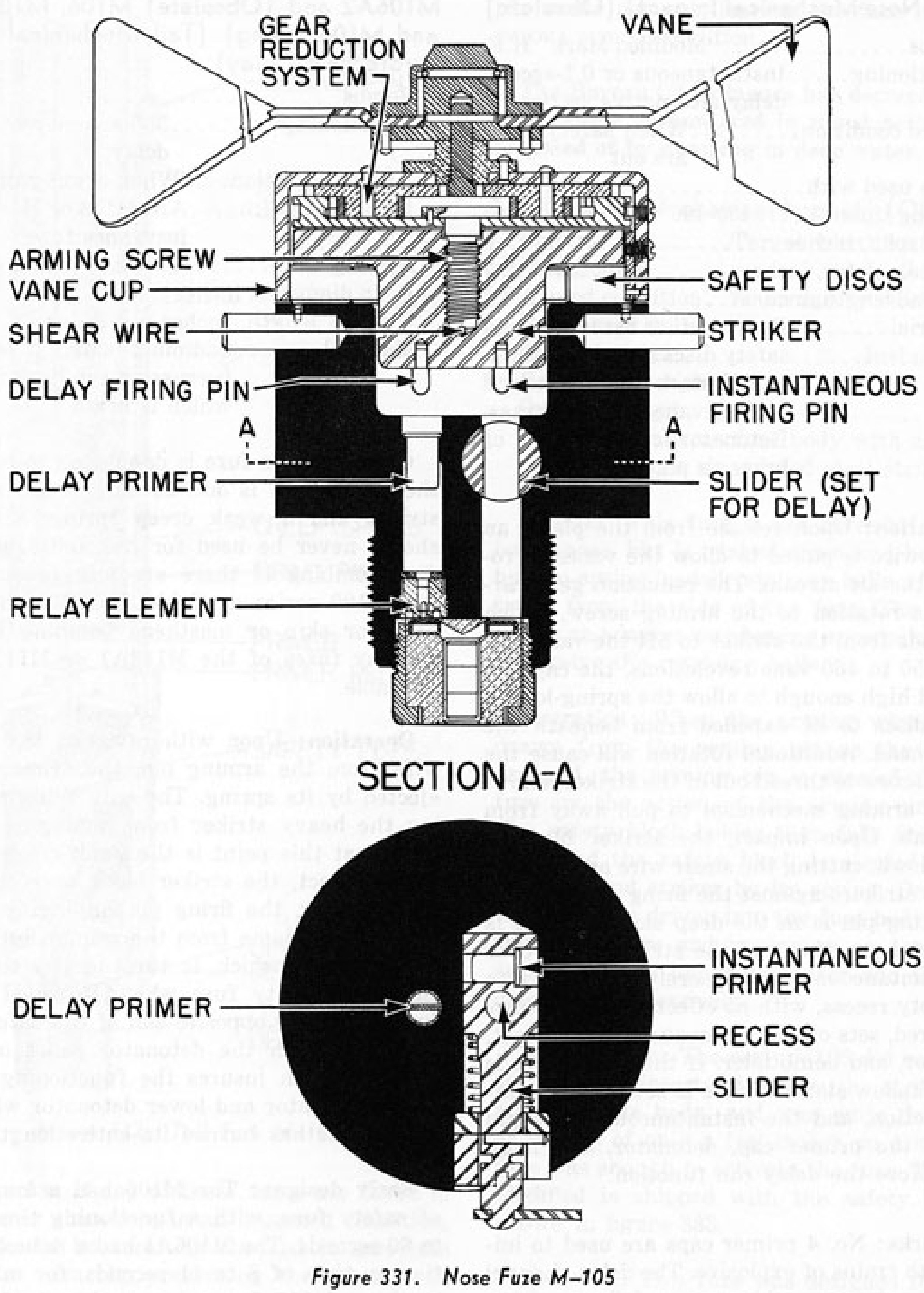


Figure 331. Nose Fuze M-105

M105 (Nose Mechanical Impact) (Obsolete)

Bombs . . . . "Modified Mark" H.E.
Functioning . . . . . Instantaneous or 0.1-second delay alternative settings
Armed condition . . . . When safety discs are out
Fuzes used with M106
Arming time . . . . 450-460 vane revolutions
Vane span, inches 6
Body diameter, inches 2.7
Over-all length, inches 4.3
Material . . . . Body, striker assembly, and safety discs are of cadmium-plated steel. Gear train and arming vane hub is of brass. Detonator cup may be of brass or plated steel.

Operation: Upon release from the plane, an arming wire is pulled to allow the vanes to rotate in the air stream. The reduction gear carries this rotation to the arming screw, which unthreads from the striker to lift the vane cap. After 450 to 460 vane revolutions, the cap will be lifted high enough to allow the spring-loaded safety discs to be expelled from beneath the striker head. Additional rotation will cause the arming screw to thread out of the striker, allowing the arming mechanism to pull away from the bomb. Upon impact, the striker block is forced down, cutting the shear wire and forcing the two strikers against the firing assembly. If the setting pin is in the deep slot, the fuze is set for delay action and the striker point over the instantaneous channel merely protrudes into the empty recess, with no effect; the delay cap, being fired, sets off the delay and relay element, detonator, and bomb filler. If the setting pin is in the shallow slot, the fuze is set for instantaneous action, and the instantaneous firing pin sets off the primer cap, detonator, and main filler, before the delay can function.

Remarks: No. 4 primer caps are used to initiate both trains of explosive. The delay channel and detonator assembly are as follows: delay train of 0.32 grains of black powder, the relay charge of 1.47 grains of lead azide.

M106A2 and (Obsolete) M106, M106A1, and M106 (Long) (Tail Mechanical Impact Pyrotechnic Delay)

Bombs . . . . G.P.
Functioning . . . . 3–5 second pyrotechnic delay
Armed condition . . . . When arming pin is out
Fuzes used with . . . . AN–M103 or M105, as an insurance fuze
Arming time . . . . Instantaneous
Body diameter, inches 1.5
Over-all length, inches 9.4
Material . . . . Cadmium-plated steel except percussion cap housing, which is brass

General: This fuze is dangerous to handle if the arming pin is out, because it has a heavy striker and a weak creep spring. This fuze should never be used for horizontal, glide, or dive bombing if there are any fuzes of the AN–M100 series available. It should never be used for skip or masthead bombing if there are any fuzes of the M112A1 or M115 series available.

Operation: Upon withdrawal of the arming wire from the arming pin, the arming pin is ejected by its spring. The only thing preventing the heavy striker from impinging on the primer at this point is the weak creep spring. Upon impact, the striker block overcomes the creep spring, the firing pin impinging on the primer. The flame from the primer ignites the primer pellet, which, in turn, ignites the short length of safety fuse which is coiled in the fuze body. The opposite end of the safety fuse is primed with the detonator pellet of black powder, which insures the functioning of the upper detonator and lower detonator when the safety fuse has burned its entire length.

Early designs: The M106 had a longer coil of safety fuse, with a functioning time of 45 to 60 seconds. The M106A1 had a reduced functioning time of 8 to 11 seconds, for masthead bombing. M106, Long, was used in the Modified Mark series 2,000-lb G.P. bomb, having an over-all length of 31.3 inches.

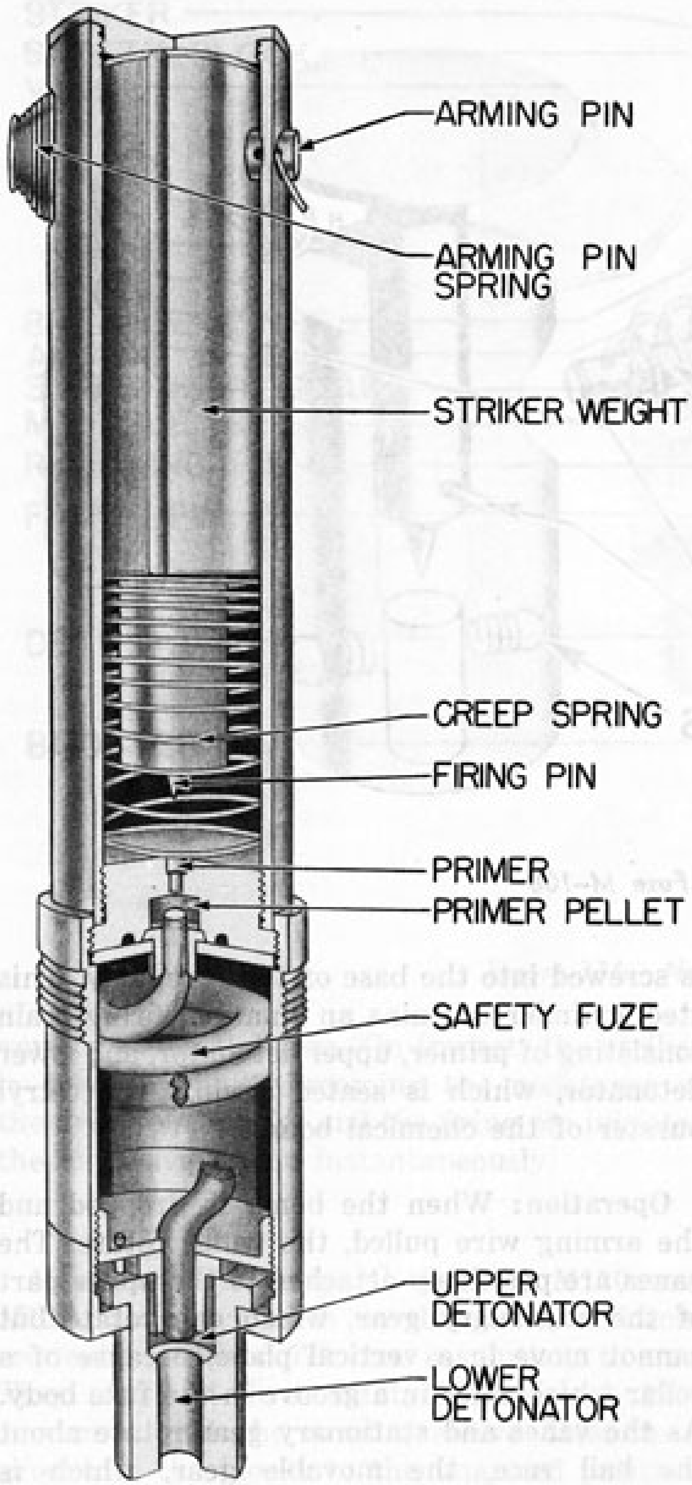


Figure 332. Tail Fuze M–106

Remarks: If any of these fuzes are found in storage or elsewhere in an unarmed condition, they should be carefully checked to ascertain that the wire clip preventing the arming pin from being ejected by its spring is in good condition and not rusted or weak. Should this clip or wire rust through and give way, the arming pin would pop out, leaving the fuze in a dangerous armed condition.

The Bureau Of Ordnance has decreed that all these fuzes encountered in naval activities be disposed of by dumping in deep water.

M108 (Nose Mechanical Impact) (Obsolete)

Bombs	Target Identification M75
Functioning	Instantaneous
Armed condition	When safety block is gone
Fuzes used with	None
Arming time	Instantaneous
Body diameter, inches	1.3
Over-all length, inches	2.6
Material	Brass fuze body with cadmium- or zinc-plated steel striker

General: This fuze is not threaded into the bomb nose, but is pushed down and held there by two spring-loaded retaining balls which protrude from the side of the fuze. The fuze requires an adapter ring having an annular groove to receive the retaining balls.

Operation: When the arming wire is withdrawn from the arming pin as the bomb is dropped, the arming pin is ejected from the fuze by the action of the arming-pin spring. The safety block holder then falls free of the fuze, and the safety block is ejected clear of the fuze and striker by its spring. On impact, the striker is driven into the fuze body, cutting the shear wire and impinging on the primer, setting off the upper detonator and the lower detonator successively.

Early design: The early M108 did not have a safety block inserted between the striker head and the fuze body, and was quite dangerous, as a drop of only a few inches on a hard surface was enough to activate the fuze. The M108 Modified is shipped with the safety block as shown in figure 333.

Remarks: This fuze was designed for use in the 100-pound Incendiary Bomb M47. It is being replaced by the AN–M126A1 in all bombs except the Target Identification Bomb M75.

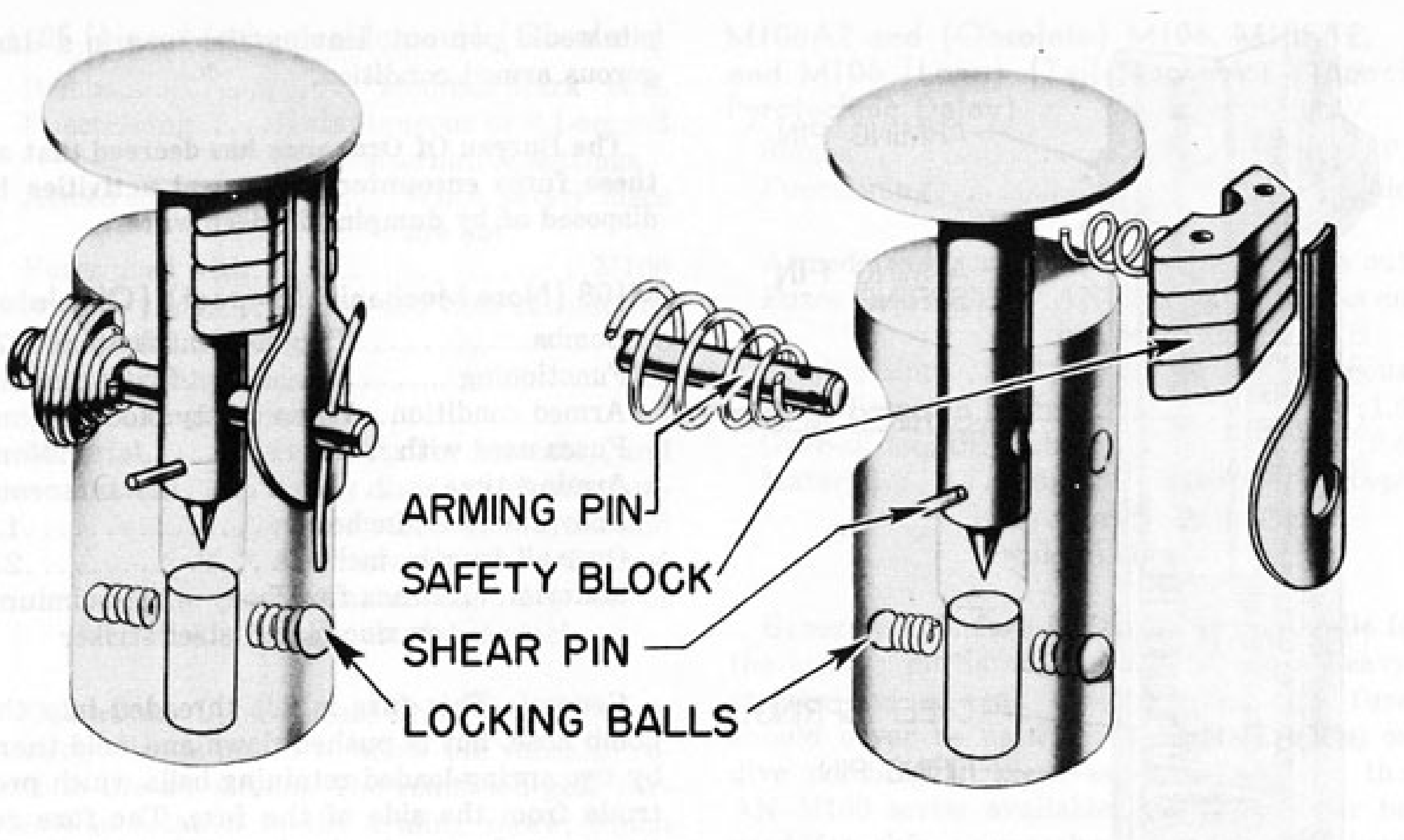


Figure 333. Nose Fuze M–108

AN–M110A1, AN–M126A1, M110 (Obsolete), and M126 (Obsolescent) (Nose Mechanical Impact)

Bombs	20-lb. Frag. AN–M41A1 115-lb. M70 Chemical
AN–M126A1	100-lb. Chemical AN–M47A2
Functioning	Instantaneous
Armed condition	When safety block is gone
Fuzes used with	None
Arming time	260 vane revolutions
Vane span, inches	3.0
Body diameter, inches	1.7
Over-all length, inches	AN–M110A1—3-5/8 AN–M126A1—3-1/16
Material	Aluminum body with steel safety blocks and striker

General: These two fuzes are identical in both construction and operation. The only difference is that the booster is eliminated from the AN–M126A1. Instead of the booster, a steel cylinder, having the same dimensions as the booster, is screwed into the base of the fuze body. This steel cylinder contains an enlarged firing train consisting of primer, upper detonator, and lower detonator, which is seated against the tetryl burster of the chemical bombs.

Operation: When the bomb is dropped and the arming wire pulled, the vanes rotate. The vanes are positively attached to the upper part of the stationary gear, which can rotate but cannot move in a vertical plane, because of a collar which rides in a groove in the fuze body. As the vanes and stationary gear rotate about the ball race, the movable gear, which is threaded up inside the stationary gear, also rotates. Both gears mesh with an idler gear, and (since the movable gear has one more tooth than the stationary gear) for each rotation the movable gear lags one tooth, thus unscrewing downward from the stationary gear. As the sleeve of the movable gear moves down, it releases the safety block, allowing the block to be expelled by centrifugal force. The sleeve is moved down far enough in 260 rotations of the

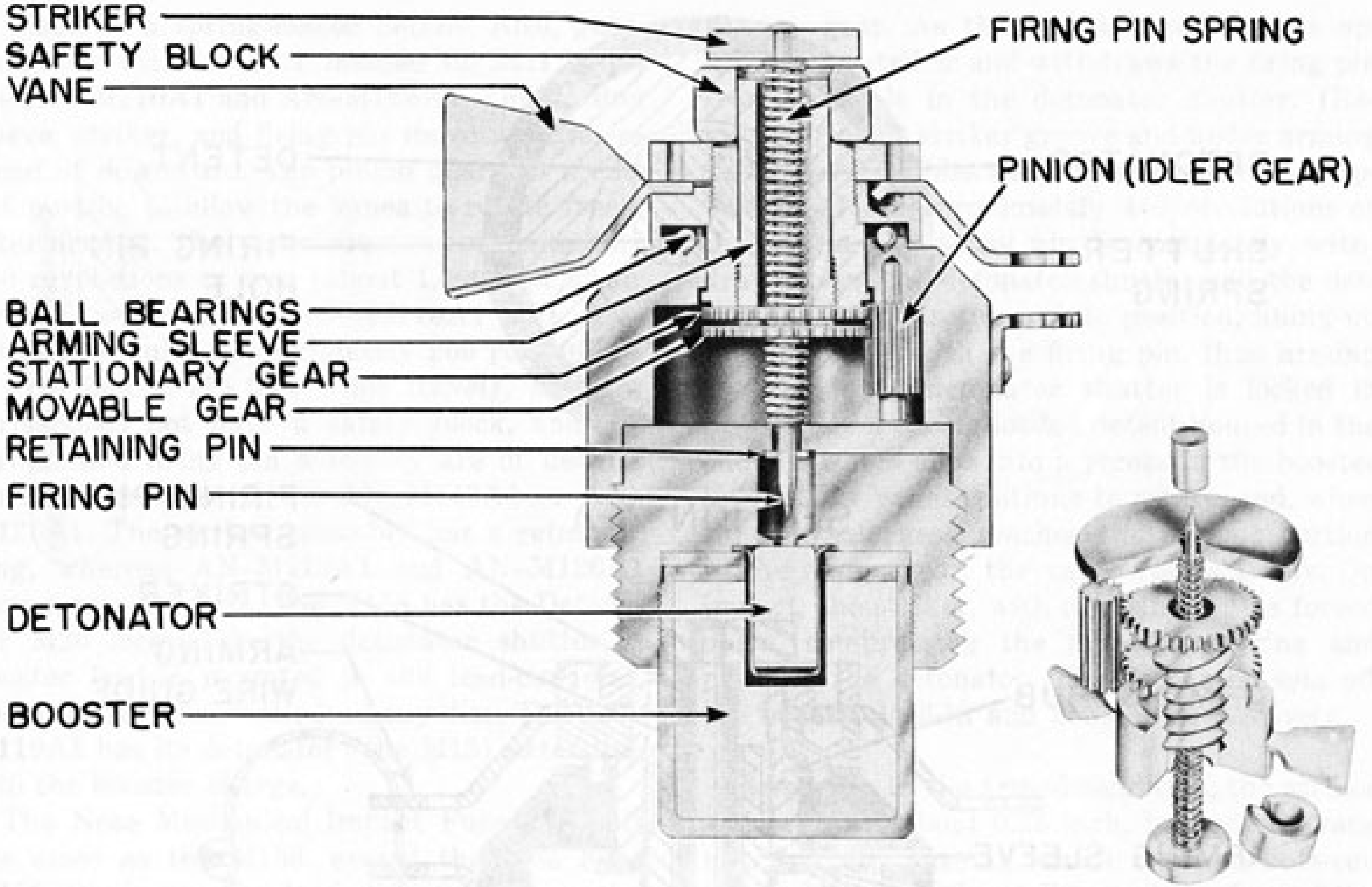


Figure 334. Nose Fuze AN–M110A1

vanes to arm the fuze. On impact, the striker is driven down, overcoming the resistance of the firing-pin spring; and the firing pin initiates the explosive action instantaneously.

Remarks: The original designs, M110 and M126, had more teeth on the gears, and consequently required 570 vane revolutions to arm. They also had three safety blocks, each 120° segments, and the arming sleeve fitted in a groove in the blocks in the unarmed position, preventing them from falling out. The original designs also had larger vanes.

If the striker head is flush with the fuze body, the fuze is in a fired condition. In such condition, the striker should not be pulled away from the fuze, as the firing pin is sensitive and withdrawal might create sufficient friction to ignite the primer.

M158 and M159 (Nose Mechanical Impact)

Bombs
M158 . . . . . Frag. AN–M41 and AN–M41A1
115-lb. Chemical M70
M159 . . . . . 100-lb. M47A2 (H)
100-lb. M47A2 (WP)
100-lb. Incend. AN–M47A2
100-lb. Incend. AN–M47A3

Functioning . . . . Instantaneous
Armed condition . . . . When striker protrudes 0.25 inches beyond vane nut
Fuzes used with . . . . None
Arming data . . . . 440 vane revolutions; 1,000 feet of air travel
Vane span, inches 3.0
Body diameter, inches 1.752
Over-all length, inches
M158 . . . . 3.69
M159 . . . . 3.22
Material . . . . Aluminum body with steel safety blocks and striker

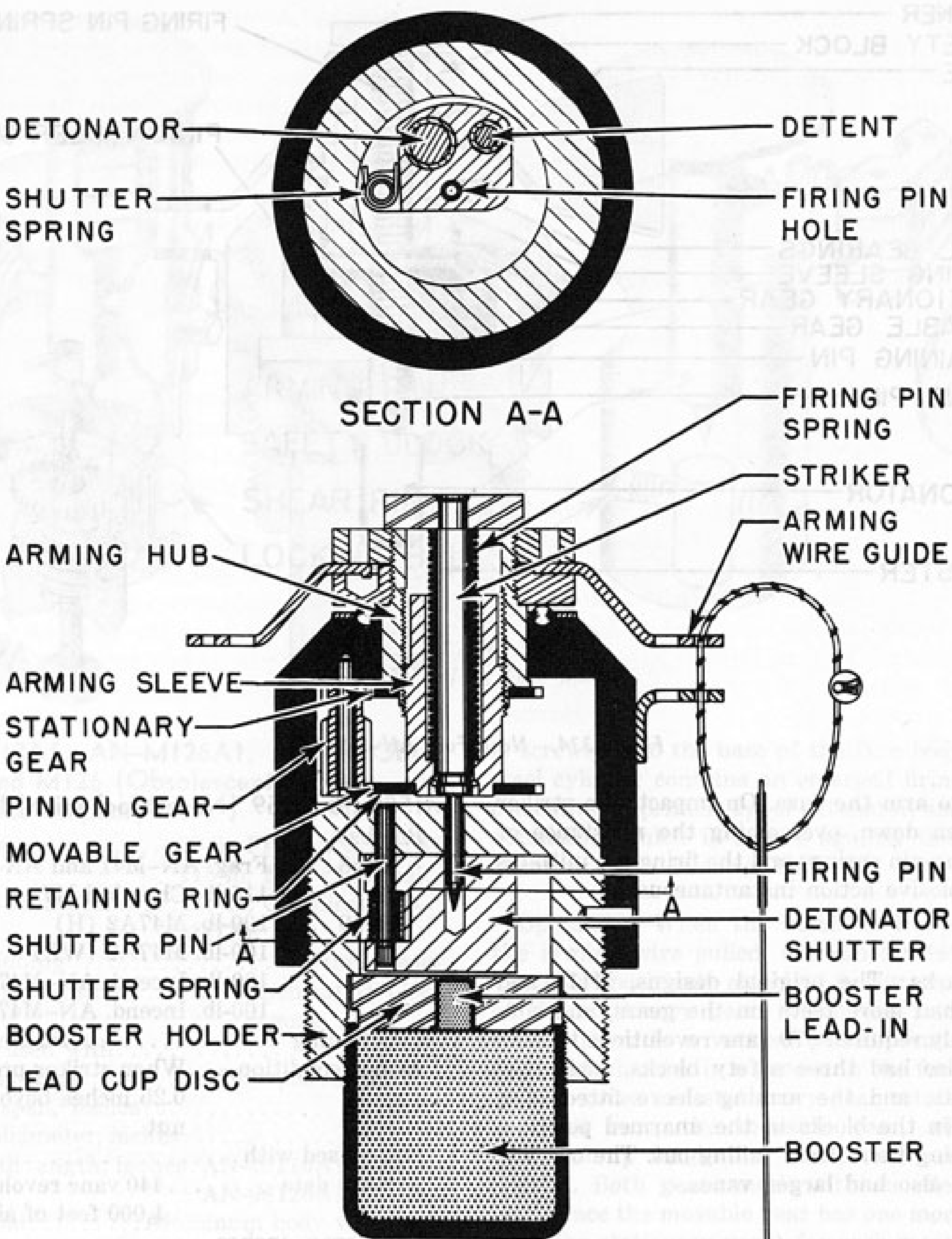


Figure 335. Nose Fuze M158

General: These fuzes are essentially the same as the Nose Mechanical Impact Fuzes AN–M110A1 and AN–M126A1, except that they incorporate a spring-actuated detonator shutter which rotates into position after withdrawal of the firing pin, and is locked

in place by a spring-loaded detent. Also, gear-reduction ratio is 40:1 instead of 34:1 as in the AN–M110A1 and AN–M126A1. The arming sleeve, striker, and firing pin move upward instead of downward. The pinion gear has a cut-out portion to allow the vanes to rotate freely after arming. The vanes require approximately 440 revolutions to arm (about 1,000 feet of air travel), whereas the AN–M110A1 and AN–M126A1 require approximately 260 revolutions to arm (about 725 feet of air travel). The new series does not have a safety block, and the striker and firing pin assembly are of heavier construction than in the AN–M110A1 or AN–M126A1. The striker assembly has a retaining ring, whereas AN–M110A1 and AN–M126A1 have a retaining pin. The M158 has the Detonator M20 located in the detonator shutter, a booster lead-in mounted in the lead-cup disc, and a booster below the lead-cup disc. The AN–M110A1 has its detonator (the M13) extending into the booster charge.

The Nose Mechanical Impact Fuze M-159 is the same as the M158, except that the Fuze M159 eliminates the lead disc (which carries lead cup) and the booster, but incorporates a detonator holder (top of holder fits flush against shoulder of booster holder) which is essentially the same as the AN–M126A1 detonator holder assembly except that it has an all-tetryl detonator which acts as relay detonator. The Nose Mechanical Impact Fuze M159 has two arming-wire guides to facilitate positioning of the arming wire, where the M158 has one. The over-all length of the M159 is approximately the same as the AN–M126A1, but shorter than the over-all length of the M158.

Operation: When the bomb is dropped and the arming wire pulled, the vanes rotate. The arming vane, nut, outer ball race, arming hub, and stationary gear rotate as a unit, but cannot move in a vertical plane because of a collar on the arming hub. The movable and stationary gears mesh with the pinion gear (idler gear), and (since the movable gear has one more tooth than the stationary gear) for each rotation the movable gear lags one tooth, thus screwing upward (right-hand threads) and toward the stationary gear. As the movable gear moves up, it lifts the striker and withdraws the firing pin from the hole in the detonator shutter. (Retaining ring in striker groove and under arming sleeve bevel enables simultaneous movement upward.) After approximately 440 revolutions of the vanes, the firing pin is completely withdrawn from the detonator shutter and the detonator shutter is swung into position, lining up the detonator with the firing pin, thus arming the fuze. The detonator shutter is locked in position by a spring-loaded detent housed in the shutter which slips into a recess in the booster holder. The vanes continue to rotate, and, when the movable gear reaches the cut-out portion in the pinion gear, the vanes rotate freely. On impact, the striker, with its firing pin, is forced down, compressing the firing-pin spring and piercing the detonator. The detonator sets off the booster lead-in and booster successively.

Remarks: In the armed condition, the striker will protrude about 0.25 inch, beyond the vane nut, but any fuze in which the gap between the underside of the striker and the face of the vane nut exceeds 0.125-inch should be treated as armed.

M111, M111A1, M111A2, M127, and M138 (Nose Clockwork Aerial Burst)

Bombs
- M111A2........Parachute Flare AN–M26; Photoflash AN–M46; Fragmentation Cluster Adapters M15 and M16
- M127..........Incendiary Cluster Adapter M10A1
- M138..........Incendiary Cluster Adapter E6R2

Functioning.........5–92 seconds, or impact instantaneous

Armed condition.........When safety block and arming pin are both out

Fuzes used with.....................None

Arming time............Approximately 260 revolutions

Vane span, inches.......................3

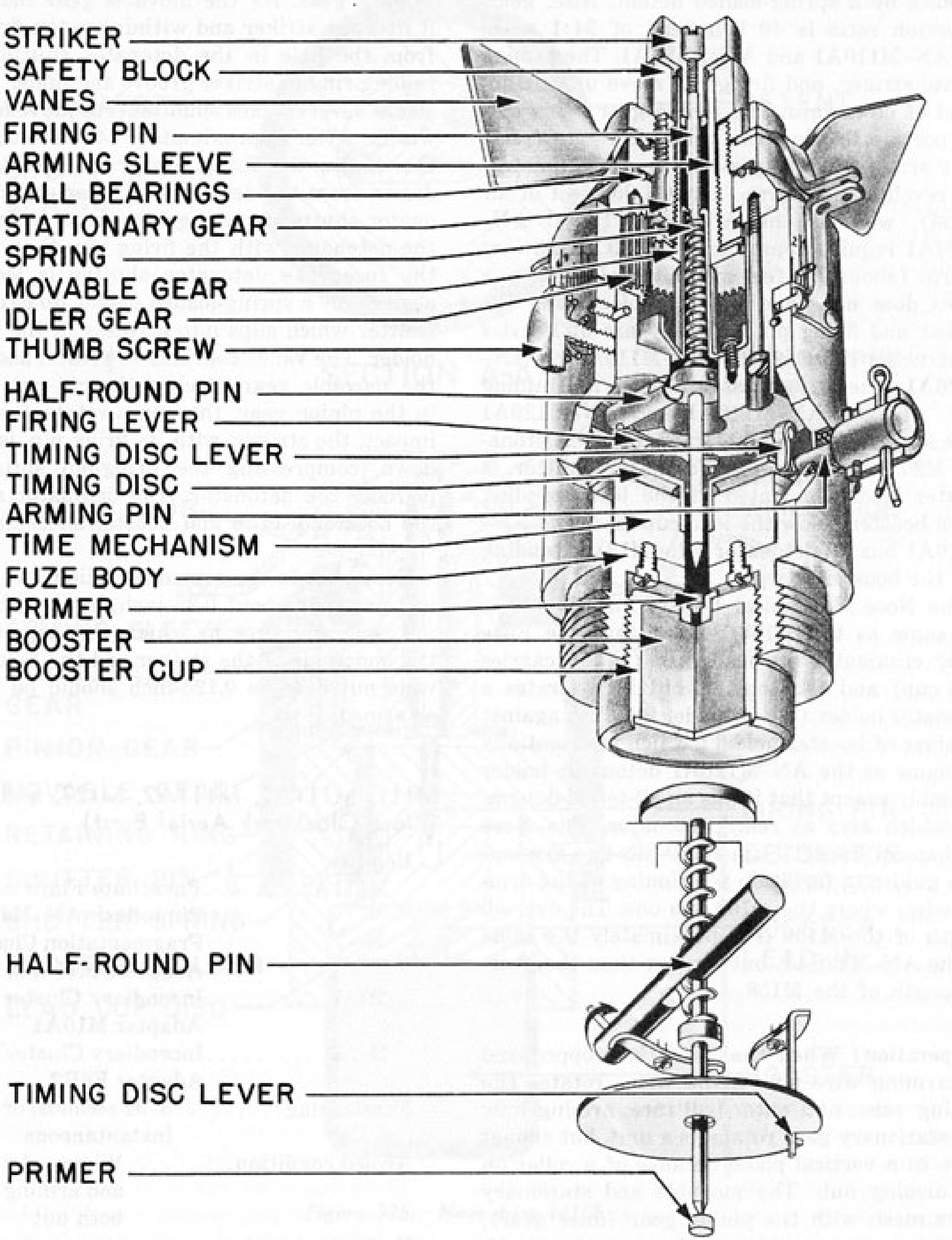


Figure 336. Aerial Burst Fuze M111A2

Body diameter, inches 1.63
Over-all length, inches . . M111A2—4.5; M127 and M138—4.95
Material . . . . Aluminum alloy body with zinc- or cadmium-plated steel striker

General: The Nose Clockwork Aerial Burst Fuze M127 is formed by assembling the booster and detonator assembly from a Nose Mechanical Impact Fuze AN–M110A1 to a M111A2 fuze body. The result is a mechanical time fuze with an 18-gram tetryl booster instead of a black powder booster such as in the M111A2. The Nose Clockwork Aerial Burst Fuze M138 is the same as the M127, except that the M138 has only 7 grams of tetryl, the balance of the space being taken up by an inert clay pellet. (M127 booster was too powerful for Cluster Adapter E6R2 and damaged the bombs in the cluster; hence, reduction of tetryl.)

Operation: The desired time interval is set on the graduated scale, and the locking screw tightened. Upon release of the cluster or flare from the plane, the arming wire is withdrawn from the fuze. The vanes are then free to rotate, and the arming pin jumps out. The arming vane, nut, outer ball race, arming hub, and stationary gear rotate as a unit. As the vanes and stationary gear rotate on the ball race, the idler gear is rotated, thus rotating the movable gear and the arming sleeve to which it is attached. The arming sleeve is threaded into the arming hub and extends inside the safety block. Since the movable gear has one more tooth than the stationary gear, it lags one tooth on every rotation and gradually unscrews downward. After approximately 260 vane revolutions, the arming sleeve has unthreaded far enough to be withdrawn from the safety block, which is then thrown clear by centrifugal force. The timing disc, meanwhile, has been rotated by the spring-driven clockwork. After the predetermined time has elapsed, the slot in the timing disc will be positioned opposite the timing disc lever. Through a series of levers, pressure forces this timing-disc lever into the slot, thus freeing the firing lever. Since the half-round pin is no longer retained by the firing lever, it is free to rotate under the pressure of the spring-loaded firing pin, a collar on the firing pin bearing on one side of the notch in the half-round pin. As the half-round pin rotates, the firing pin is released and impinges on the primer, firing the booster. If the timing mechanism should fail, the fuze would still detonate on impact, because the striker would be forced down and would shear any obstruction between it and the primer.

Early designs: The original Nose Clockwork Aerial Burst Fuze M111 had a setting range of from 15 to 93 seconds, and, because of the greater number of teeth on its gears, required 570 vane revolutions to arm.

M111A1 reduced minimum setting time on the scale from 15 to 5 seconds. The fuze, however, could not be set for less than 8 seconds, since, if set for less, the clockwork functioned before the fuze was armed, and the firing-pin spring pulled the striker down tightly against the safety blocks, stopping the rotation of the vanes, thus preventing aerial burst. Both of these early designs had three 120° section safety blocks with a groove which received the arming sleeve of the movable gear. They also had weaker gears with more teeth; and larger, weaker vanes.

Remarks: The M111A2 booster contains 70 grains of black powder.

Neither the M127 nor the M138 should be assembled to their respective clusters, until the cluster has been locked in place in the bomb rack.

The Nose Clockwork Aerial Burst Fuze M127 is being replaced by the M128; the M138 is being replaced by the M145; the M111A2 is being replaced by the M146.

These fuzes are equipped with a spinner device to force the safety block to rotate with the arming vane and insure positive ejection of the safety block after the arming sleeve has withdrawn. Only later lots of M111A2 are equipped with the spinner device.

AN–M128, AN–M145, AN–M146, and AN–M147 (Nose Clockwork Aerial Burst)

Bombs	
AN–M128	Cluster, Incendiary, AN–M17A1
AN–M145	Cluster Adapter, Incendiary, E6R2
AN–M146	Flares and photoflash; Butterfly Clusters M28 and M29 Target Identification Bombs M89, M90, M98
AN–M147	Target Identification Bomb M84; Incendiary AN–M47A2, A3
Functioning	Aerial burst, 5–92 seconds; or instantaneous
Armed condition	When safety collar and arming pin are both out, and detonator is aligned under firing pin
Fuzes used with	None for M128, M146 and M147; M152 or M153 used with M145
Arming time	Approximately 260 vane revolutions
Vane span, inches	3
Body diameter, inches	1.93
Over-all length, inches	AN–M128, AN–M145—6.2; AN–M146—5.67; AN–M147—5.72.
Material	Aluminum alloy body with zinc- or cadmium-plated steel striker

General: These fuzes modify the Nose Clockwork Aerial Burst Fuze M111A2 by the addition of a detonator slider held out of line until the fuze is partially armed by a crank-shaped arming stem. The four fuzes in the series are identical, except for the boosters employed; the AN–M128 has the booster of the M127 (tetryl); the AN–M145, that of the M138 (tetryl-clay pellet); the AN–M146, that of the M111A2 (black powder); and the AN–M147, the AN–M126A1 primer detonator, instead of a booster.

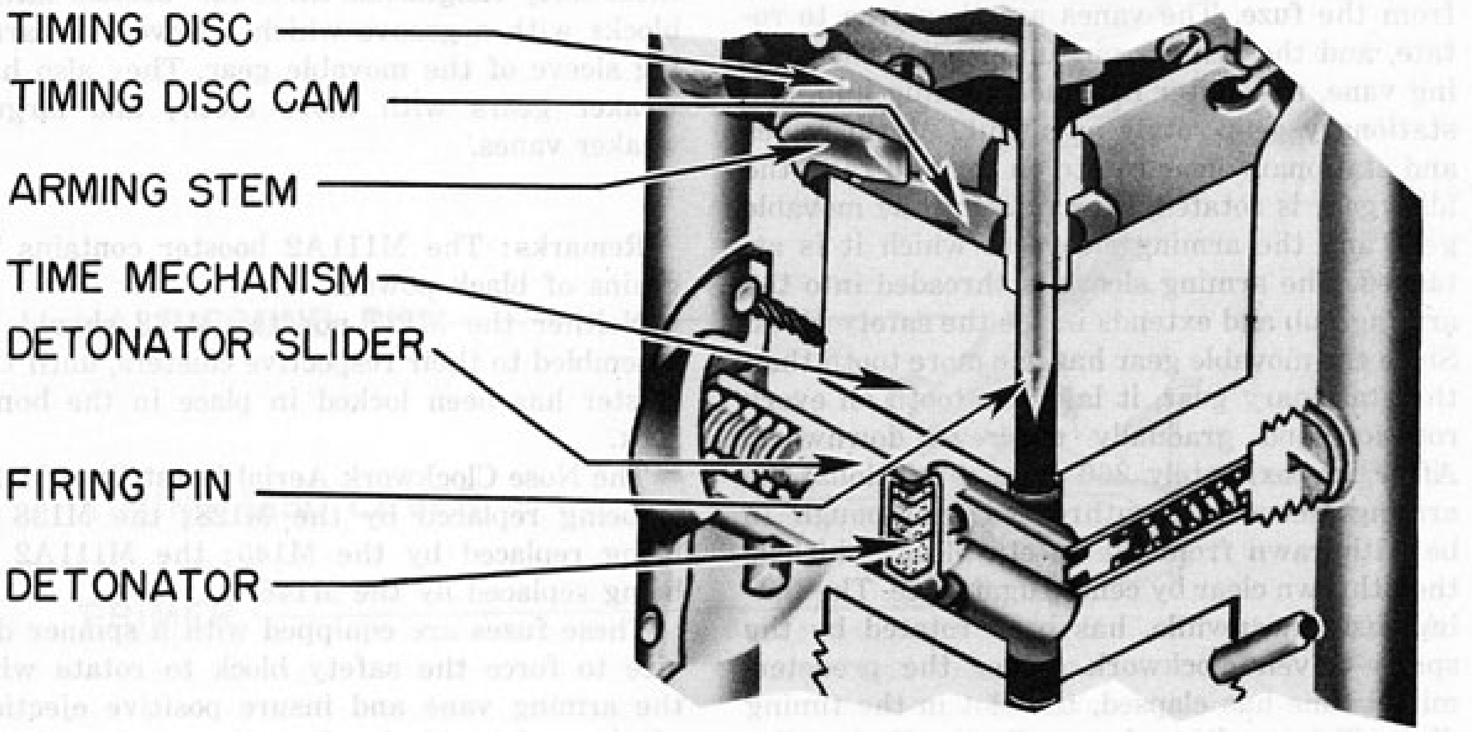


Figure 337. Aerial Burst Fuze AN–M128

Operation: Same as M111A2, except that, after approximately four seconds of rotation of the timing disc, the release arm located below the timing disc, and turning with it, frees the crank-shaped end of the arming stem. The lower end of the arming stem then presents its cut-away section to the detonator slider, which will then align itself below the firing pin and become locked in place there by a spring-loaded detent.

When the detonator is aligned, the timing disc continues to turn. After the predetermined time has elapsed, the slot in the timing disc will be positioned opposite the timing-disc lever. Through a series of levers, pressure forces this timing-disc lever into the slot, thus freeing the firing lever. This, in turn, frees the half-round cocking pin, which is forced to rotate under pressure of the spring-loaded firing pin. As the half-round cocking pin rotates, the firing pin is released and impinges on the primer, firing the booster.

Remarks: The AN–M128 replaces the M127; AN–M145 replaces the M138; and AN–M146 replaces the M111A2.

These fuzes are equipped with a spinner device to force the safety block to rotate with the arming vane; this assures positive ejection of the safety block after the arming sleeve has withdrawn.

M135, M136, M135A1, and M136A1 (Nose Clockwork Aerial Burst)

Bombs	All G.P.; and 4,000-lb. L.C. AN–M56. May be found in 90-lb. and 260-lb. Frag.; 500-lb. and 1,000-lb. Chemical
Functioning	M135 — 5 to 92 sec. M136 — 5 to 30.6 sec. (Both will function on impact.)
Armed condition	When safety block, arming pin, and lower arming pin are out
Fuzes used with	None normally, unless AN–M100A2 series is used for insurance
Arming time	Approximately 260 revolutions
Vane span, inches	3.6
Body diameter, inches	2.7
Over-all length, inches	9.1
Material	Upper part of body is aluminum alloy; lower part, cadmium-plated steel

General: These fuzes are a combination of the Nose Clockwork Aerial Burst Fuze M111A2 and the Nose Mechanical Impact Fuze AN–M103, in which the former fuze has been assembled to a modified body and booster portion of the Fuze AN–M103. The setting pin of the AN–M103 has been removed, and in its place the spring-loaded lower arming pin has been inserted. The lower arming pin holds the detonator carrier out of line with the firing train until the arming wire is pulled.

The Nose Clockwork Aerial Burst Fuze M135 incorporates a time setting which can be adjusted to the nearest 0.1 second, and the fuze will fire accurately within plus or minus one second; time calibrations are made for every half second, with a 10-division vernier scale located on the non-rotating part of the fuze for setting to the nearest 0.1 second.

The M136 incorporates a time setting which can be adjusted to 0.2 of a second, and the fuze will fire accurately within plus or minus 0.3 second. The greater accuracy of the M136 is achieved by an improved clockwork mechanism. This fuze was developed to provide greater accuracy, presupposing that a method can be devised for accurately measuring the altitude of release.

Operation: Prior to loading the fuzed bomb into the plane, the time setting is made and the time set screw tightened. The arming wire is withdrawn as the bomb is dropped, and the vanes start to rotate. The arming pin is ejected, and the time mechanism starts to operate, the lower arming pin being simultaneously ejected, allowing the spring-loaded detonator carrier to move over into the armed position. After ap-

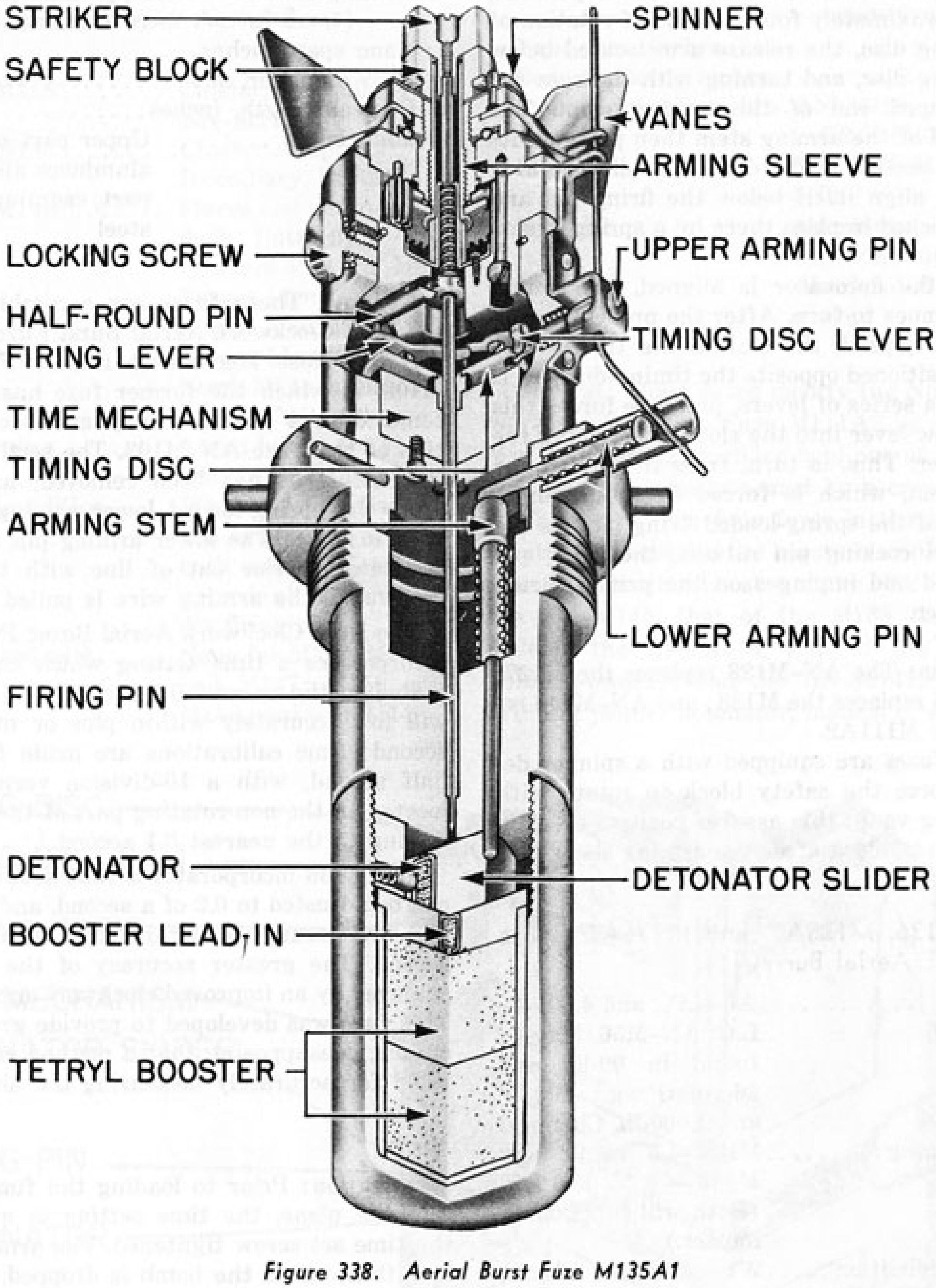


Figure 338. Aerial Burst Fuze M135A1

proximately 750 feet of air travel, the safety block is released from the fuze. After the set time has expired, the firing pin will be freed and its spring will force it into the primer and detonate the bomb.

The bomb may detonate if it strikes a target

prior to complete functioning of the time mechanism, provided the arming wire has been withdrawn, in which case the firing pin would shear the rather delicate levers obstructing it.

Remarks: Effective use of these fuzes in G.P. bombs presupposes that a method can be devised for accurately measuring the altitude of release.

The round knurled locking screw has been replaced in current production with a wing-nut type, and replacement wing nuts are being sent to the field. This change was made so that ordnance personnel can get a good grip on the nut and eliminate the possibility that the setting might slip and cause either premature or late functioning.

The Nose Clockwork Aerial Burst Fuzes M135A1 and M136A1 are the same as the M135 and the M136, except that they incorporate a lower time limit of 10 seconds instead of 5 seconds. The minimum setting time was increased to prevent any possibility of damage to the plane by the bomb fragments. The M135A1 and the M136A1 will replace the M135 and the M136 respectively, when available. It is recommended that a minimum setting of 10 seconds be used for all M135 and M136 fuzes now in the field.

M144 (Nose Clockwork Aerial Burst)

Bombs	250-lb. Target Identification M89, M90, M98
Functioning	1.6 — 30.6 sec., or instantaneous if slider aligned
Armed condition	When safety collar and arming pin are both out, and detonator is aligned under firing pin
Fuzes used with	None
Arming time	6 to 9 vane revolutions
Vane span, inches	3
Body diameter, inches	1.93
Over-all length, inches	5.67
Material	Aluminum alloy body with zinc- or cadmium-plated steel striker

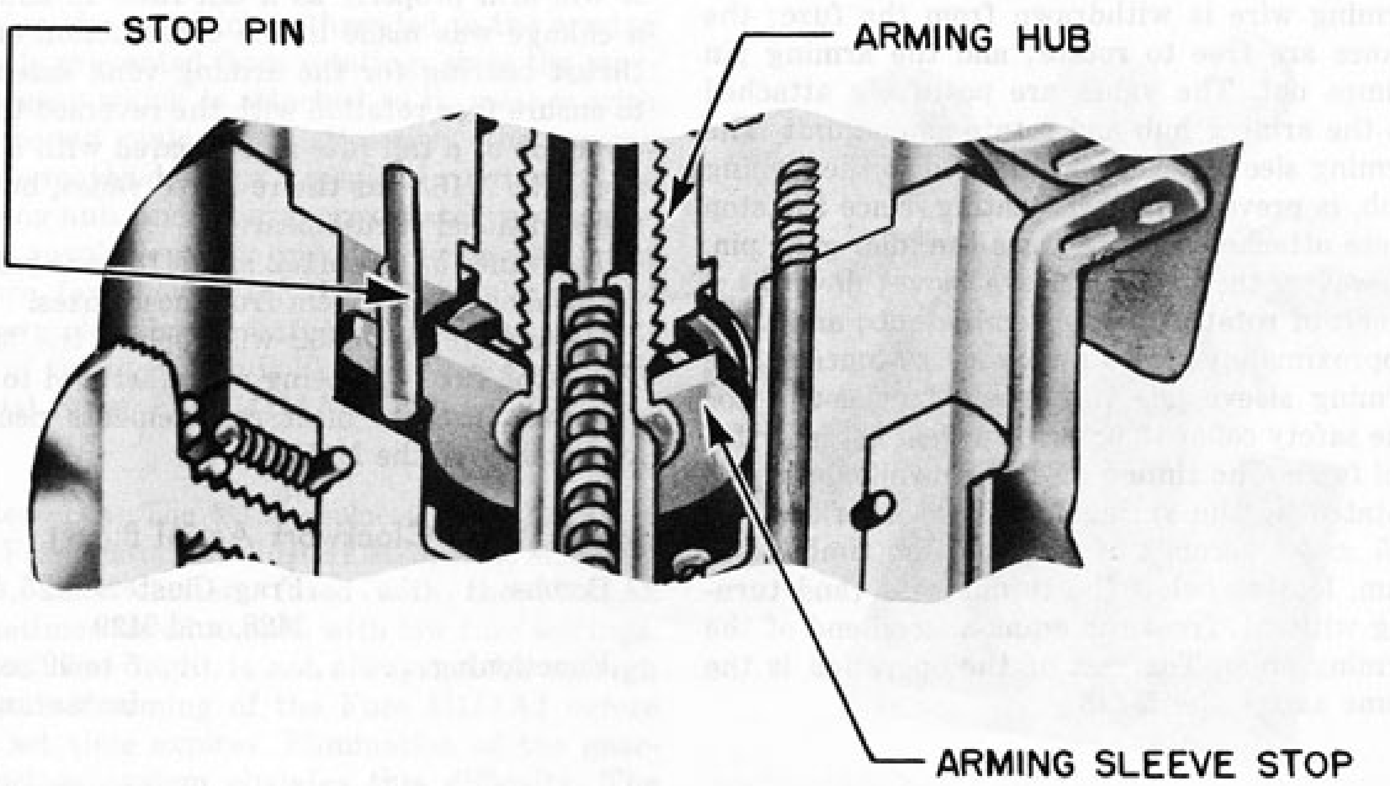


Figure 339. Aerial Burst Fuze M144

General: The Nose Clockwork Aerial Burst Fuze M144 is similar to the AN–M146, except that it has direct-drive instead of gear-reduction arming, resulting in ejection of the safety block after approximately six to nine turns of the arming vane. The direct drive involves the removal of the stationary gear from the arming hub, the movable gear from the arming sleeve, and the idler gear from the pin. The arming-sleeve stop plate fixed to the bottom of the arming sleeve has a fork which engages the pinion-gear pin and prevents the arming sleeve from rotating. This change was made to ensure that the safety block is ejected in less than the mechanical functioning time of the fuze. In addition, the M144 incorporates a clock mechanism which runs three times as fast as the AN–M146 clock mechanism. This results in a minimum setting of 1.6 seconds instead of 5, a maximum setting of 30.6 seconds instead of 92, and a slider arming time of 1.5 ± 0.5 seconds instead of 4.5 ± 1.5. Because of the shorter running time, the clockwork is more accurate in the M144.

Operation: Upon release of the bomb, the arming wire is withdrawn from the fuze; the vanes are free to rotate; and the arming pin jumps out. The vanes are positively attached to the arming hub and rotate as one unit. The arming sleeve, which is threaded to the arming hub, is prevented from rotating, since the stop plate attached to it engages the idler-gear pin. However, the arming sleeve moves down as a result of rotation of the arming hub; and after approximately six to nine vane revolutions the arming sleeve has withdrawn far enough for the safety collar to be thrown clear by centrifugal force. The timing disc, meanwhile, has been rotated by the spring-driven clockwork. After 1.5 ± 0.5 seconds of rotation, the timing-disc cam, located below the timing disc (and turning with it), frees the crank-shaped end of the arming stem. The rest of the operation is the same as for the M146.

M152, and M153 (Tail Mechanical Aerial Burst)

Bombs	Incendiary Cluster Adapter M23
Functioning	5 to 92 seconds; or instantaneous if slider aligned
Armed condition	When safety collar and arming pin are both out, and detonator is aligned under firing pin
Fuzes used with	Nose Fuze AN–M145
Arming time	Approximately 260 vane revolutions
Vane span, inches	3
Body diameter, inches	1.93
Over-all length, inches	6.2
Material	Aluminum alloy body with zinc- or cadmium-plated steel striker

General: The Tail Mechanical Aerial Burst Fuze M152 is the same as the AN–M145, except that the M152 has reversed vanes so that it will arm properly as a tail fuze. In addition a change was made in the construction of the thrust bearing for the arming vane assembly, to ensure free rotation with the reversed thrust direction of a tail fuze as compared with a nose fuze. The M153 has the reversed vanes, but not the additional thrust bearing.

The vanes of the M152 and M153 are painted red to distinguish them from nose fuzes.

Remarks: The M152 will replace the M153. The M153 fuze was being manufactured to provide tail fuzes to meet requirements pending availability of the M152.

M155 (Nose Clockwork Aerial Burst)

Bombs	Frag. Clusters M26, M27, M28, and M29
Functioning	5 to 92 sec., or instantaneous

Armed condition	When safety block and arming pin are both out
Fuzes used with	None
Arming time	Approximately 6 to 9 vane revolutions
Vane span, inches	3
Body diameter, inches	1.63
Over-all length, inches	4.5
Material	Aluminum alloy body with zinc- or cadmium-plated steel striker

General: The Nose Clockwork Aerial Burst Fuze M155 is the same as the M111A2, except that the gear-reduction system has been eliminated. A spinner device is incorporated to force the safety block to rotate with the arming vane. Elimination of the gear-reduction system has been accomplished by removing the stationary gear from the arming hub, and pinning the pinion gear in place so that it cannot rotate.

Operation: The vanes are posicively attached to the arming hub and rotate as one unit. The arming sleeve, which is threaded to the arming hub, is prevented from rotating, since the movable gear which is attached to it, meshes with the bound pinion gear. However, the arming sleeve moves down as a result of rotation of the arming hub, and after approximately six to nine vane revolutions the arming sleeve has withdrawn far enough for the safety block to be thrown clear by centrifugal force. The remainder of the operation is like the Nose Clockwork Aerial Burst Fuze M111A2.

Remarks: The M155 replaces the M111A2 in the Fragmentation Clusters M26, M27, M28, and M29, since clusters fuzed with the M111A2 sometimes failed to open with low fuze settings. The cluster flight is not always stable enough to permit arming of the Fuze M111A2 before the set time expires. Elimination of the gear-reduction system obviates this difficulty. The spinner insures ejection of the safety block at completion of arming.

T77 (Nose Clockwork Aerial Burst)

General: The T77 is an M111A2 fuze body with anemometer vanes, instead of the propeller vanes. This development was produced to ensure proper functioning of this type of fuze when used in the Fragmentation Bomb Cluster M26, or earlier model of the cluster.

The cluster may tumble in flight, preventing ordinary vanes from rotating sufficiently in the proper direction to arm the M111A2; hence the anemometer vanes were substituted.

Description: Modification kits are issued to provide parts for converting the M111A2 into the T77 when the fuze is to be used in the fragmentation cluster. The kit contains the anemometer vane, vane nut, safety block, and fuze fixture. This fuze fixture serves as a support for the fuze during the process of modification.

Remarks: No such modification is necessary on the M155, because it arms in six to nine turns of the vanes.

Figure 340. Aerial Burst Fuze T77

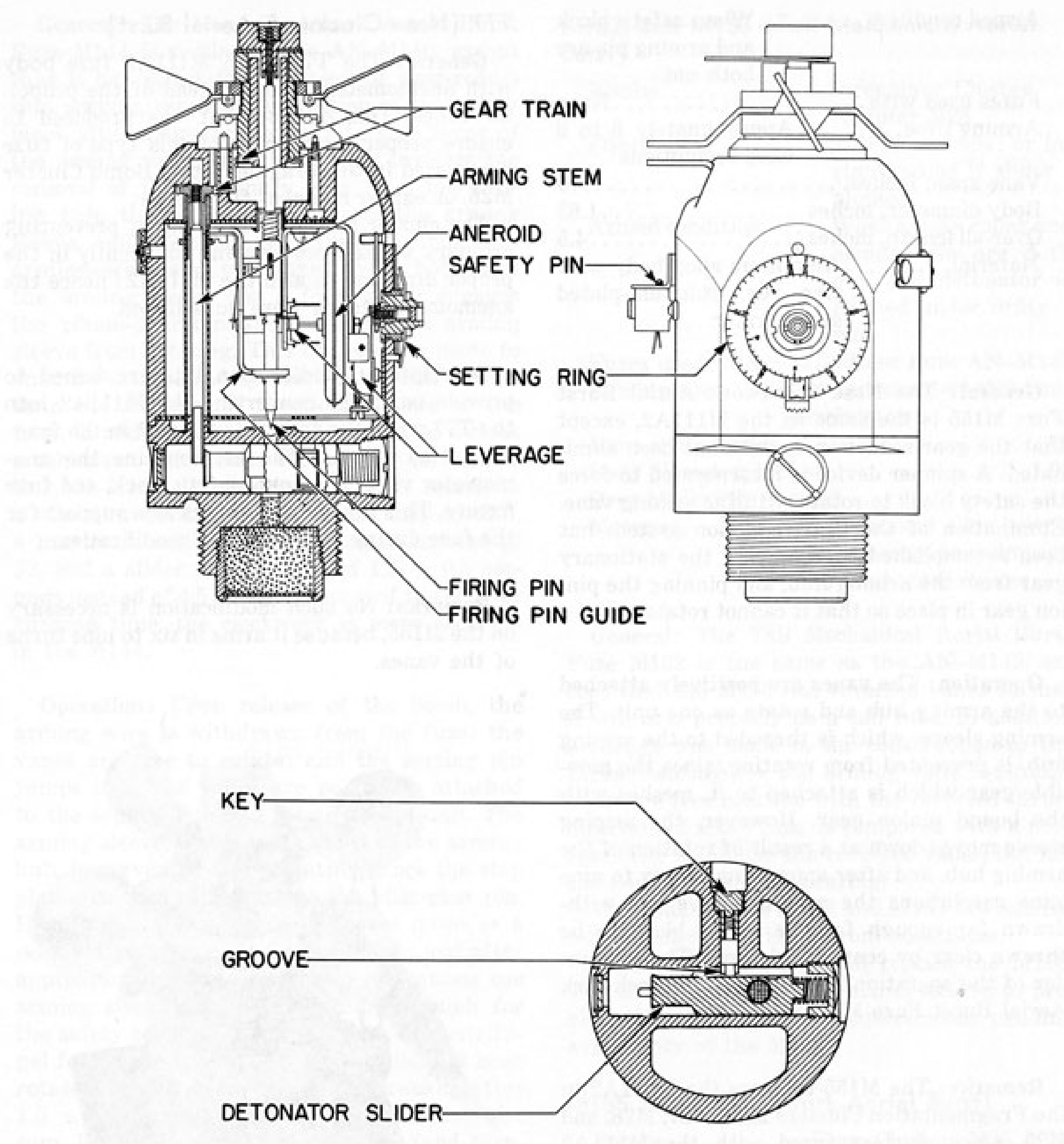


Figure 341. T27E4 Nose Barometric Fuze

T27E4 (Nose Barometric)

Bombs . . . . Not determined
Functioning . . . . Preset to fire at certain pressure (altitude)

Armed condition . . . . Safety pin out; vane rotation
Diameter, inches . . . . 2.6 (approx.)
Vane span, inches 3.2
Over-all length, inches 6.0

General: This is an experimental design to obtain accurate firing at preset barometric pressure levels, and thus facilitate firing at exact altitudes (possibly within 200 feet of the setting). The fuze was originally designed for flares, but may be employed for other tactical purposes as testing continues.

Description and operation: Being air-travel armed, the T27E4 has vanes and gears similar to the M111 type of fuze. However, the gears act to thread an arming stem in the side of the fuze upward, allowing the spring-loaded detonator slider to be moved out and in line with the firing pin. A key screw in the fuze base rides in a slot in the side of the detonator slider and prevents rotation or misalignment of the detonator slider.

The safety pin on the outside of the fuze body locks the trip-firing mechanism. This pin is removed by the arming wire as the bomb is released. When this safety pin is removed, the aneroid bellows is free to move (through its leverage system) the trip-firing mechanism when the fuze reaches an area of pressure corresponding to that set on the dial.

M112, M113, and M114 (Obsolescent), and A1 Modifications (Tail Mechanical Impact)

Bombs
- M112A1........100-lb. G.P. AN–M30
  250-lb. G.P. AN–M57
- M113A1........500-lb. G.P. AN–M43, 64
  500-lb. S.A.P. AN–M58
  600-lb. G.P. M32
- M114A1........1,000-lb. G.P. AN–M44,65
  1,000-lb. S.A.P. AN–M58
  1,100-lb. G.P. M33
  2,000-lb. G.P. AN–M34,66
  2,000-lb. S.A.P. M103

Functioning....Primer Detonators M16 and M16A1 with 4 to 5, 8 to 11, or 8 to 15 seconds delay are interchangeable

Armed condition....When vane assembly has risen 0.75 inch

Fuzes used with........................None

Arming data.........18–21 vane revolutions; 100 feet of air travel

Vane span, inches........................ 5

Body diameter, inches..................1.5

Over-all length, inches.......M112A1— 9.6
M113A1—12.6
M114A1—16.6

Material.............Cadmium-plated steel

General: These fuzes are designed for ship and masthead bombing by land-based planes. The only difference in these three fuzes is in the length of the arming stem. Larger bombs require a longer arming stem, so that the vanes can catch the air slip from the bomb.

Operation: As the vanes rotate, the arming stem is unthreaded from the plunger. There are no reduction gears in the vane assembly, the arming stem being secured to the vane nut by a cotter pin; and 18 to 21 revolutions of the vanes will free the plunger. A key pin riding in a groove in the plunger prevents it from rotating as the arming stem is withdrawn. On impact, the plunger compresses its creep spring and the spring-loaded firing pin forces the locking balls out into the enlarged part of the fuze cavity, freeing the firing pin. The cocked firing-pin spring forces the firing pin against the primer, initiating the delay in the primer detonator.

Early designs: The original M112, M113, and M114 used the Primer Detonator M16, which is the same as the M16A1 except that the shoulder is lower. Hence, when the Primer Detonator M16A1 was designed, it was necessary to alter the base of the fuze slightly to permit use of this primer detonator with the higher shoulder on its external surface. The alternative Primer Detonators M16 had delays of 4 to 5 or 8 to 11 seconds, whereas the longer-delay M16A1 has a range of from 8 to 15 seconds. This delay consists of a barium chromate silicon powder in place of the lead chromate silicon mixture used in the Primer Detonator M16. The M16, though no longer being manufactured, can still be used in the Tail Mechanical Impact Fuzes M112A1, M113A1, and M114A1.

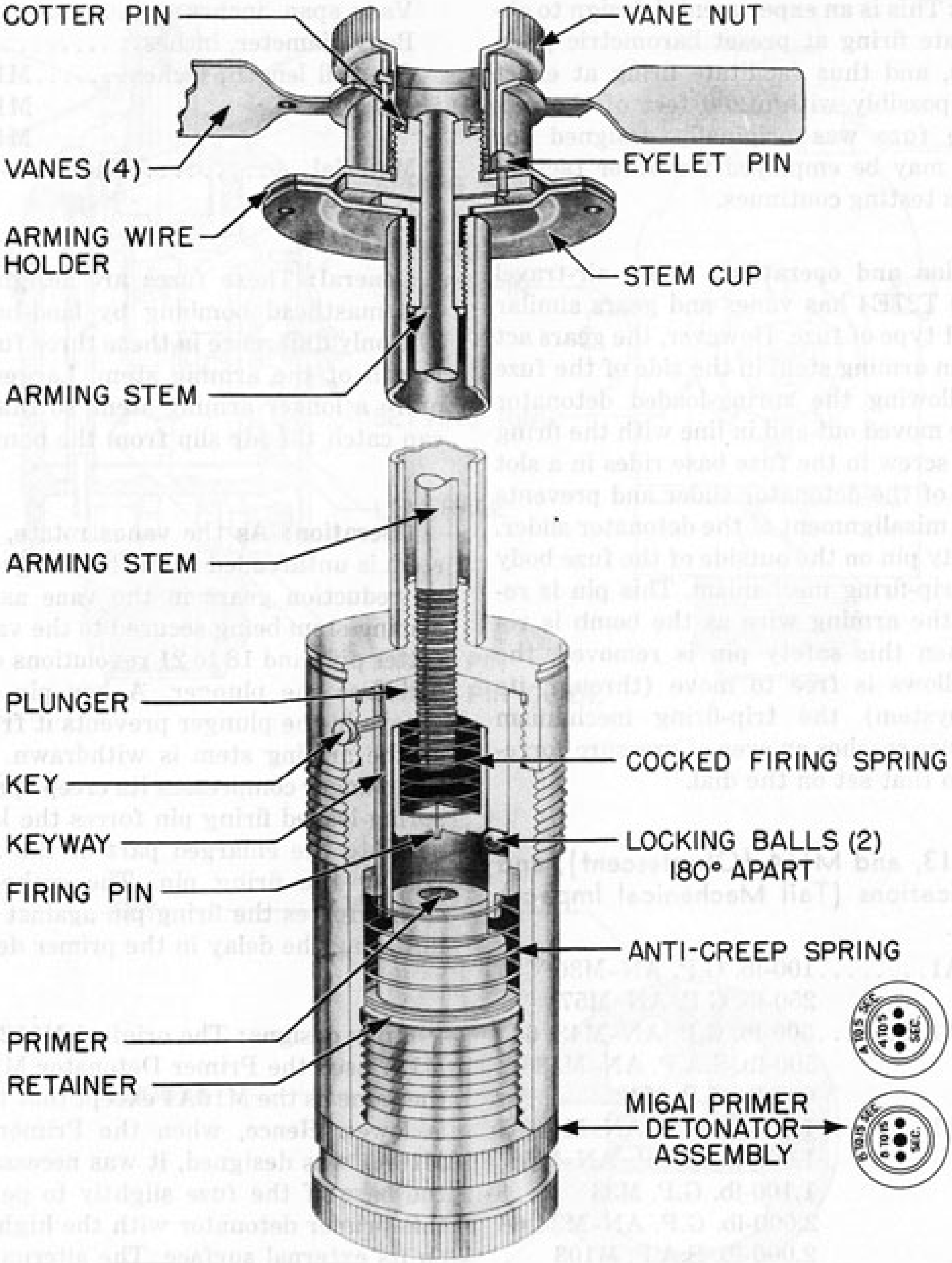


Figure 342. Tail Fuze M112A1

Remarks: **This fuze will function on an impact angle of 3°, and gives positive action because of its cocked firing pin. This fuze is unsafe for carrier landings. Delay of 4 to 5 seconds should be used against sea targets, and delay of 8 to 15 seconds against land targets.**

Never turn the vanes counterclockwise to render the fuze safe, as the arming stem may depress the plunger instead of engaging it.

These fuzes may have a groove around the top of the fuze body, or the top may be straight

like the AN–M100 series fuzes. This groove is a distinguishing mark used by those manufacturers making both the M112 and AN–M100 series fuzes, and is not to be considered a positive mark for fuze identification.

M115, M116, and M117 (Tail Mechanical Impact)

Bombs
- M115..........100-lb. G.P. AN–M30
  250-lb. G.P. AN–M57
- M116..........500-lb. G.P. AN–M43, 64
  ....500-lb. S.A.P. AN–M58
  600-lb. G.P. M32
- M117..........1,000-lb. G.P. AN–M44, 65
  1,000-lb. S.A.P. AN–M58
  1,100-lb. G.P. M33
  2,000-lb G.P. AN–M34, 66
  2,000-lb. S.A.P. M103

Functioning.....Primer Detonators M16A1: 4–5, 8–15 seconds delay
Primer Detonators M16: 4–5, 8–11 seconds delay

Armed condition.....When gear carrier stop protrudes less than 1 inch below vane cup

Fuzes used with........................None

Arming data.....Same as AN–M100A2, AN–M101A2, AN–M102A2 respectively

Vane span, inches..........................5

Body diameter, inches......................1.5

Over-all length, inches..........M115— 9.6
M116—12.6
M117—16.6

Material.............Cadmium-plated steel

General: This series is for ship and masthead bombing by land- or carrier-based planes. The only difference between these fuzes is in the length of the arming stem. Larger bombs require a longer arming stem, so that the vanes can catch the air slip from the bomb. The only difference between these three fuzes and the M112A1 series is that this series employs the reduction gears as used in the AN–M100A2 series, consequently having a longer arming time. Actually, the M115 series is a composite of the M112 series body with the AN–M100A2 series vane and reduction-gear assembly.

Remarks: These fuzes will take either the Primer Detonators M16 with delays of 4 to 5 or 8 to 11 seconds, or the Primer Detonators M16A1 with delays of 4 to 5 or 8 to 15 seconds. Actually the M16's are no longer being manufactured, though they are still to be found in the field. These fuzes can be used for skip or masthead bombing from land or carrier bases. These fuzes may have a groove around the top of the fuze, or the top may be straight as in the AN–M100 series. The groove is a distinguishing mark used by manufacturers making both fuzes, and is not to be considered a positive sign for fuze identification.

Never turn the vanes counterclockwise to render a fuze safe, as the arming stem may depress the plunger instead of engaging it.

M151 (Tail Mechanical Impact)

Bombs.......100-lb. AN–M30A1 and 250-lb. G.P. AN–M57A1 equipped with Anti-Ricochet Parachute M7 and Fuze Adapter M202; 500-lb. G.P. AN–M64A1, equipped with Anti-Ricochet Parachute M6 and Fuze Adapter M200

Functioning....4 to 5 or 8 to 15 seconds delay

Armed condition....Consider armed if arming stem extends $1\frac{5}{16}$ inches from fuze body (vane shaft side); or after approximately 12 vane revolutions.

Fuzes used with........................None

Arming time........Approximately 12 vane revolutions

Vane span, inches..........................5

Body diameter, inches......................1.5

Over-all length, inches....................5.55

Material............Cadmium-plated steel

General: The Tail Mechanical Impact Fuze M151 consists of a modified M112A1 series fuze body. The body has been lengthened to accommodate a plunger stem which is attached to the plunger proper. A transverse arming stem replaces the regular in-line arming stem. A retainer pin and spring-type lock nut have been

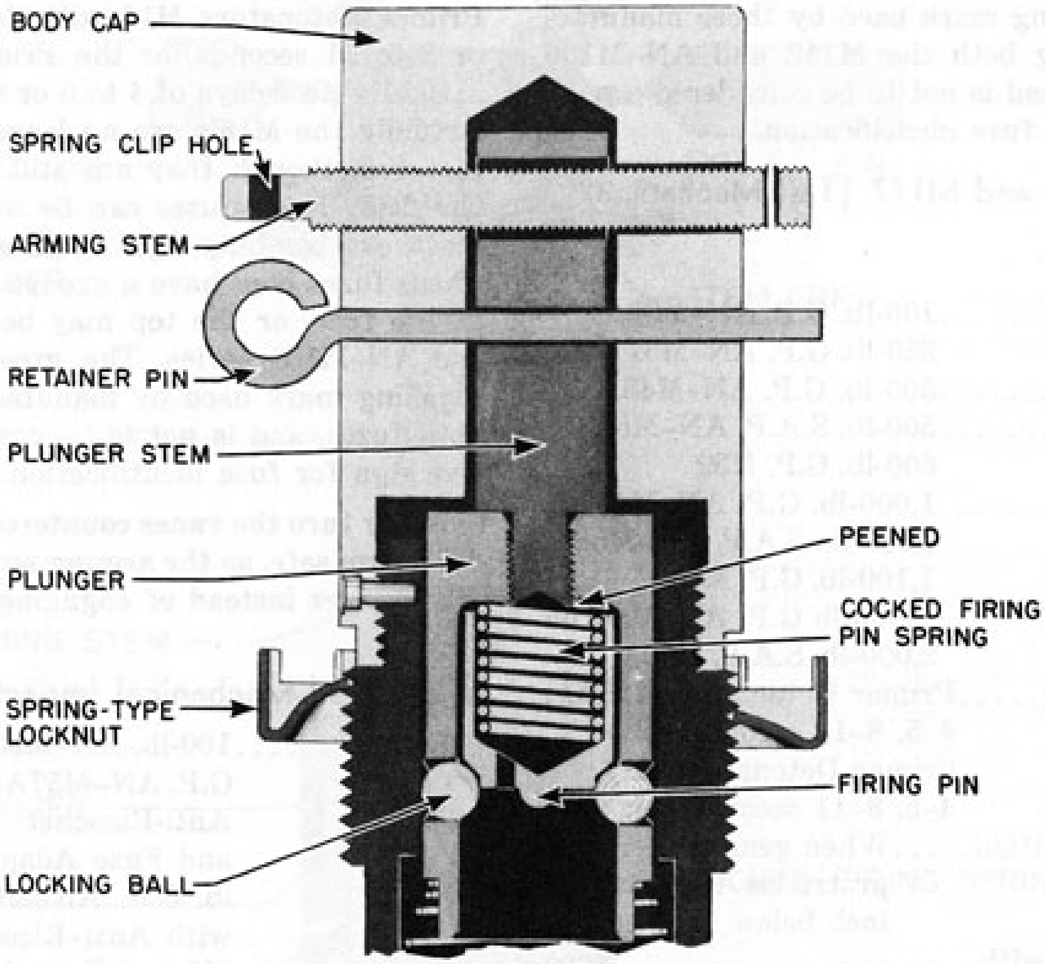


Figure 343. Tail Fuze M151

incorporated. In addition, the M151 uses an anemometer-type vane. The anemometer-vane arming shaft is attached to the arming stem by a spring clip.

Operation: Upon withdrawal of the arming wire from the arming shaft, the anemometer vane is free to rotate, and causes the arming stem to unscrew from the fuze. After approximately 12 vane revolutions, the arming stem has withdrawn completely from the plunger stem, and the fuze is armed. On impact, the plunger compresses the anti-creep spring and the spring-loaded firing pin forces the locking balls out into the enlarged part of the fuze cavity, freeing the firing pin. The cocked firing-pin spring forces the firing pin against the primer, initiating the delay in the primer detonator.

Remarks: The length of the anemometer-vane arming shaft varies in length, depending on the fuze adapter used, and is considered a part of the fuze adapter. The Adapter M202 uses a 4-inch arming shaft, and the M200 uses a 7 1/8-inch arming shaft.

Depending on which M16A1 primer detonator is used, the fuze will have a 4 to 5 or 8 to 15 second delay.

M123, M124, and M125 (Obsolescent) (Tail Chemical Time, Anti-Withdrawal)

Bombs

M123	100-lb. G.P. AN–M30A1
	250-lb. G.P. AN–M57A1
M124	500-lb. G.P. AN–M64A1
	500-lb. S.A.P. AN–M58A2
M125	1,000-lb. G.P. AN–M65A1
	2,000-lb. G.P. AN–M66A1, 66A2
	1,000-lb. S.A.P. AN–M59A1
	2,000-lb. S.A.P. M103

Functioning	Chemical long-delay fuze: delays of 1, 2, 6, 12, 24, 36, 72, and 144 hours
Armed condition	Consider armed if dropped, because of glass ampoule; or after 75.6 to 190 revolutions of vanes.
Fuzes used with	None
Arming time	75.6 to 190 revolutions
Vane span, inches	5
Body diameter, inches	1.5
Over-all length, inches	M123— 9.6 M124—12.6 M125—16.6
Material	Zinc-plated and dichromate-coated steel

General: The only difference in these three fuzes is in the length of the arming stem. Functioning time is determined—for the 1-, 2-, 6-, and 12-hour delays—by varying the concentration of the alcohol-acetone solution, and for the 24-, 36-, 72-, and 144-hour delays, by varying the thickness of the celluloid disc (thickness increases as delays increase). The Detonator M19A2 contains the primer mixture of lead azide and tetryl.

Operation: The stem case and gear system of these fuzes are identical to the fuzes in the AN–M100A2 series, except that the threads on the arming stem are right-hand threads and thread downward instead of out. The pinion gear revolves around the stationary gear, and, in so doing, rotates the movable gear (which has one more tooth than the stationary gear) one tooth per revolution. Since the arming stem is secured to the movable-gear sleeve, it also rotates counter-clockwise, threading down toward the glass ampoule. The arming stem exerts pressure on the ampoule cap, causing the glass ampoule to break where it rests on seat disc and knife edge. Attached to the arming stem is a stem collar, which compresses a rubber washer to seal the upper part of the fuze from leakage (344–387 revolutions of vanes to seal). In the 1-, 2-, 6-, and 12-hour delays, the acetone or alcohol-acetone solution is freed to act on the celluloid ring retaining the locking balls. In the 24-, 36-, 72-, and 144-hour delays, the acetone is freed to act on the celluloid disc and subsequently the celluloid ring retaining the locking balls. As the acetone or alcohol-acetone solution acts on the celluloid ring, the locking balls are forced out by the head of the screw which is threaded into the spring-loaded firing pin. After the predetermined delay, as effected by varying the concentration of the alcohol-acetone solution or by varying the thickness of the celluloid disc, the balls will be forced clear of the screw head and the firing pin will strike the detonator.

If an attempt is made to withdraw the fuze, once it has been installed, the anti-withdrawal locking ball will ride into the shallow part of its groove, and lock the lower fuze body to the adapter booster. Further turning of the fuze will merely unthread the upper fuze body from the lower part, allowing the spring-loaded firing-pin sleeve to force the sleeve balls into the separation, driving both the sleeve and the firing pin toward the detonator. A separation of 3/64-inch activates the fuze, regardless of the length of time the acetone or alcohol-acetone solution has been acting, or if the fuze is in an unarmed condition. Later lots require 1 1/2 turns or 3/32-inch to activate.

Remarks: Never attempt to withdraw the fuze during or after installation in the bomb. If the bombs with this fuze are not dropped, they must be jettisoned over enemy territory or in the sea. They cannot be considered safe, even if dropped unarmed.

The fuzes should not be subjected to temperatures exceeding 120° F. (High temperature may damage the celluloid ring.) In the packing box are two vials of powder—one a green-stoppered vial, the other a red-stoppered vial. If the temperature exceeds 150° F., the powder in the green-stoppered vial will melt or solidify, and the fuzes are not to be used for low-altitude bombing. If temperature exceeds 170° F., the powder in the red-stoppered vial will melt or solidify, and the fuzes must be destroyed.

Before inserting the fuze in the bomb, gage the adapter-booster cavity with the plug gage provided in each box of fuzes. Any bomb with

which difficulty is experienced in inserting this gage, must not be fuzed with these fuzes.

Later lots of these fuzes are equipped with new-type lock nut as on the M123A1 series.

M123A1, M124A1, and M125A1 (Tail Chemical Time, Anti-Withdrawal)

Bombs.................Same as M123 series
Armed condition..Consider armed if dropped, because of glass ampoule; or after 4 to 6 turns of the vanes.
Fuzes used with.......................None
Arming time...............4 to 6 vane turns
Vane span, inches.........................5
Over-all length, inches......M123A1— 9.39
M124A1—12.39
M125A1—16.39
Material........Zinc- or cadmium-plated steel

General: The only difference in these three fuzes is in the length of the arming stem. The M123A1 series fuzes were developed to eliminate any possibility of premature firing resulting in aerial bursts, which sometimes occurred in the unstaked M123 series. Essentially, the M123A1 series differs from the M123 series in that the gear-reduction system has been eliminated, and a direct-drive arming system has been installed. Functioning time in these fuzes is determined in the same manner as the M123 series. The Detonator M19A2 contains the primer mixture of lead azide and tetryl.

Operation: When the arming wire is withdrawn, the vane assembly starts to rotate, causing rotation of the clip hub, clip, and arming stem. After about four to six turns of the vanes, the arming stem moves inward far enough to break the ampoule. Approximately five to six additional turns are sufficient to seal the fuze; i.e., the stem collar is flush against the rubber retainer washer. The balance of the operation is the same as the M123 series.

Remarks: Prior to the development of the M123A1 series, the M123 series with gear reduction was modified by pinning the body extension of the fuze to the body by use of two steel shear pins to prevent premature firing (aerial burst being caused by the torque developed by the gear-reduction system after sealing). Kits were also provided for installing these shear pins in the field.

Before the M123A1 series was in production, existing stocks of M123 series fuzes on hand in this country were modified; the stem cup was utilized without the gear-reduction assembly, and a vane hub, clip hub, clip, safety catch, and eight-bladed vane installed. This was designated the M123A1 series.

The fuzes of the M123A1 series, as well as the later M123 series lots, do not have the solvent dyed in various colors. Dye particles entered pores of the ampoule glass at the sealing point, increasing the possibility of breakage and leakage.

In the M123A1 series, if the body extension is backed off approximately 3/32 of an inch from the body, fuzes are activated, regardless of the length of time the acetone or alcohol-acetone solution has been acting, and regardless if the fuzes are in an unarmed condition.

Modification: The M123A1 series was modified, adding an ampoule-retainer sealing cup made of gilding metal, a sealing washer, set screw, and lock nut. This modification assures more effective sealing, since the arming screw crushes (but does not break through) the ampoule-retainer sealing cup. The set screw and lock nut hold the ampoule retainer in place and assure a tight fit against the retainer cup.

M132, M133, and M134 (Tail Chemical Time, Anti-Withdrawal)

Bombs.............Same as M123 series
Functioning.......10 minutes average chemical delay with range of 6–80 minutes delay possible, due to temperature variations
Armed condition....No external indication, assumed to be armed if dropped.
Fuzes used with....................None

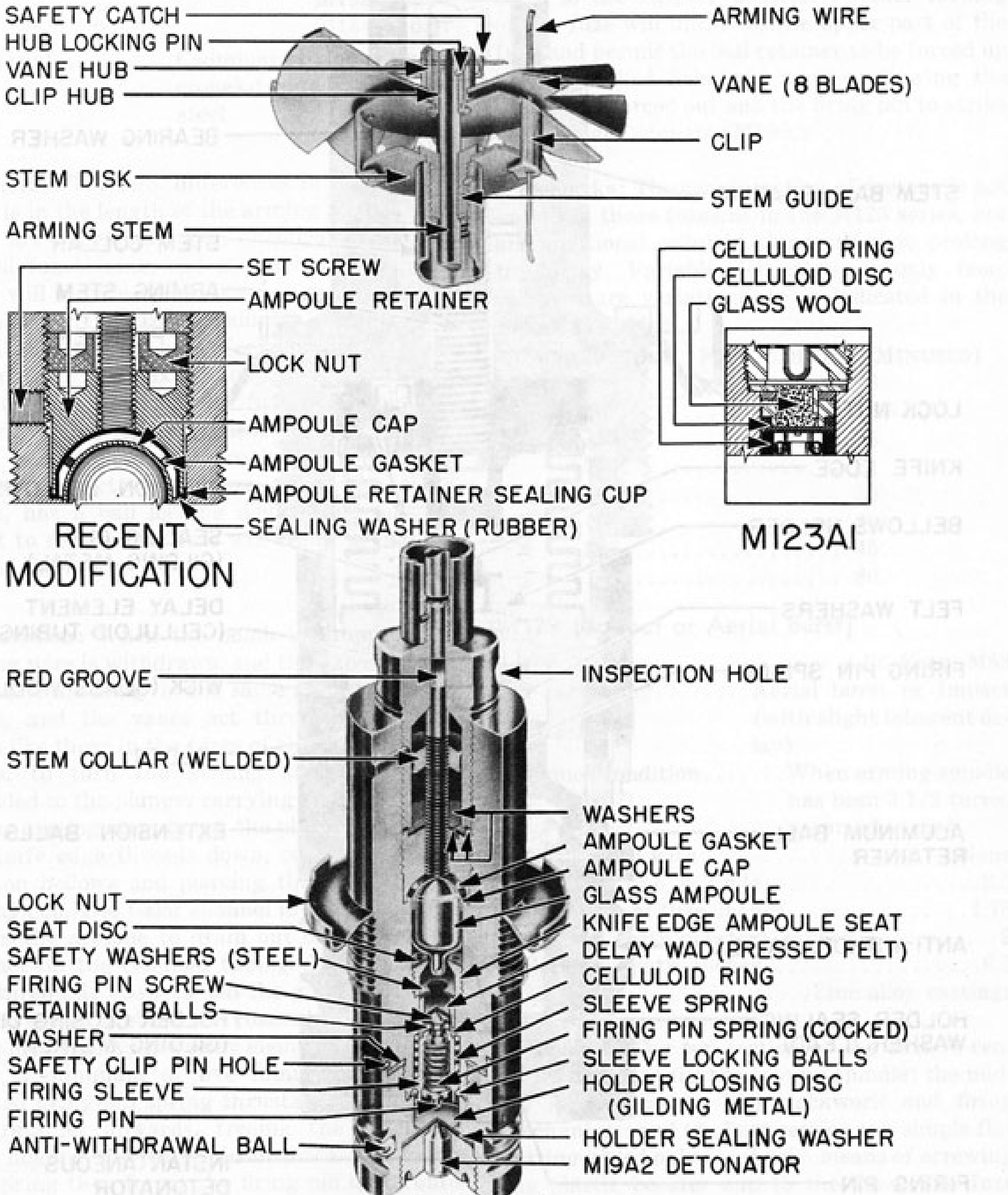


Figure 344. Tail Time Fuze M123A1

Arming time	63 vane revolutions (min.)	Vane span, inches	5
	84 vane revolutions (max.)	Body diameter, inches	1.5

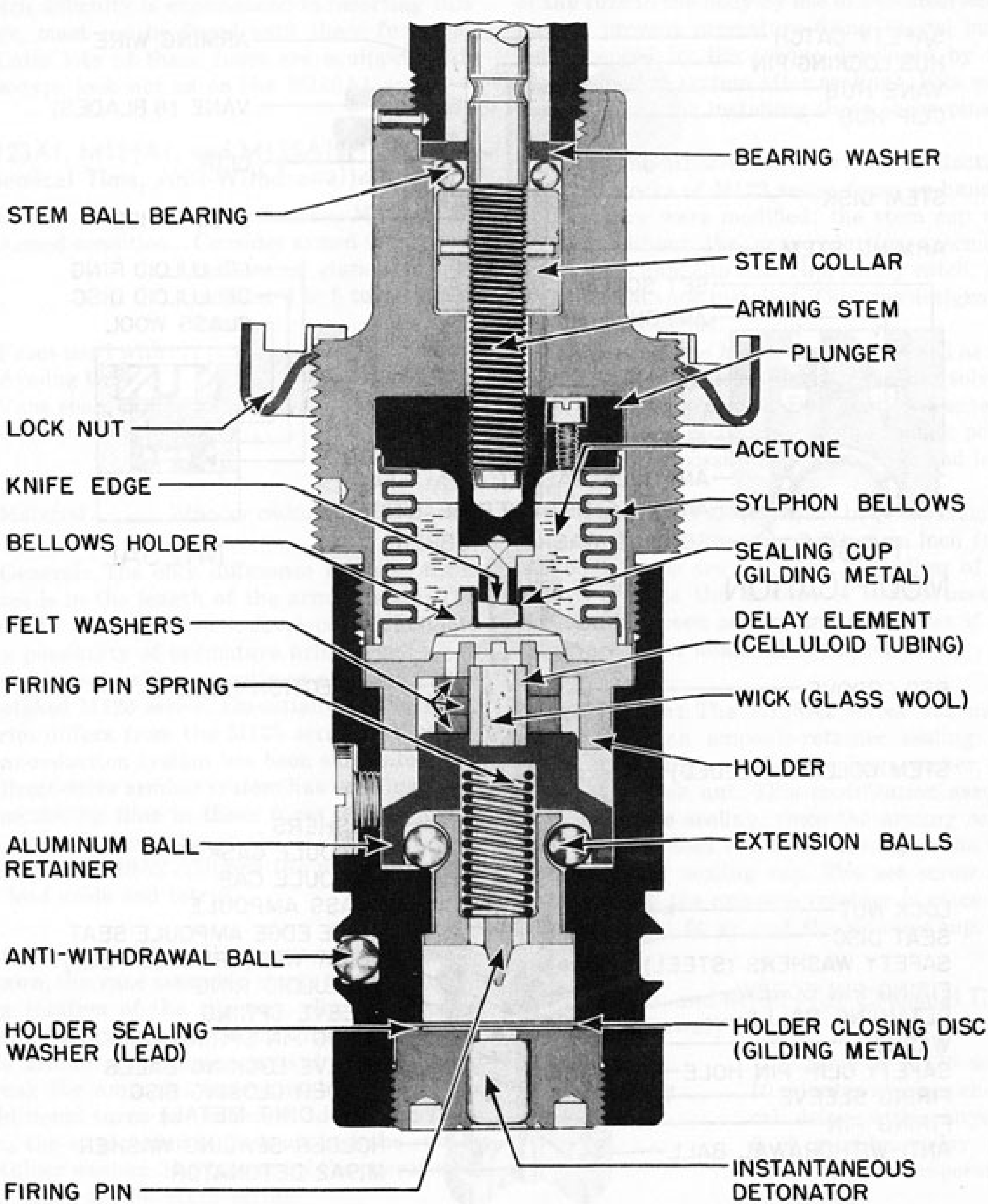


Figure 345. Tail Time Fuze M132

Over-all length, inches	M132— 9.57 M133—12.57 M134—16.57
Material	Cadmium or zinc plate, or cronak-treated zinc-plated steel

General: The only differences in these three fuzes is in the length of the arming stem. These fuzes are dependent upon chemical action for normal functioning, and atmospheric temperatures will have a direct bearing on the length of the delay. The fuzes are similar in principle to the M123 series, but are safer in that the solvent is contained in a flexible copper bellows rather than a glass ampoule. The fuze body does not project far beyond the adapter booster; hence, there is less chance of breakage upon severe multiple impacts. This fuze, as in the M123 series, has a ball locking device, and any attempt to remove the fuze will result in detonation of the bomb.

Operation: When the bomb is dropped, the arming wire is withdrawn, and the vanes rotate. The vane assembly is the same as in the M123 series, and the vanes act through reduction gears like those in the fuzes of the AN-M100A2 series, to turn the arming stem, which is threaded to the plunger carrying the knife edge. As the arming stem turns, the plunger carrying the knife edge threads down, compressing the sylphon bellows and piercing the gilded metal sealing cup. The T-slot channel in the knife edge allows the acetone to drain out of the bellows and act on the celluloid tubing delay element. The three felt washers and the glass wool wick absorb excess acetone and concentrate it on the delay element. As the delay element is dissolved after a minimum of five minutes, the compressed firing-pin spring thrusts the aluminum ball retainer upwards, freeing the extension balls holding the firing pin in place. The firing pin spring then forces the firing pin down onto the Detonator M19A2.

If an attempt is made to withdraw the fuze once it has been installed, the anti-withdrawal locking ball will ride into the shallow part of its groove and lock the lower part of the fuze body to the adapter booster. Further turning of the fuze will unthread the upper part of the fuze and permit the ball retainer to be forced up by the cocked firing-pin spring, allowing the balls to be forced out and the firing pin to strike the Primer Detonator M19A2.

Remarks: The concentration of acetone is not varied in these fuzes as in the M123 series, nor are additional celluloid plugs added to prolong the delay. Variable delays result only from temperature variations, as is indicated in the following table:

Temperature (F)	Delay (Minutes)
122°	6
110°	7.5
85°	15
70°	21
55°	30
40°	40
32°	45
10°	80

M129 (Impact or Aerial Burst)

Bomb	4-lb. Frag. M83
Functioning	Aerial burst or Impact (with slight inherent delay)
Armed condition	When arming spindle has been 3 1/2 turns, assumed armed
Fuzes used with	None
Arming time, seconds	2.5
Diameter of fuze, inches	1.75
Length (with booster), inches	2
Spindle length, inches	6.5
Material	Zinc alloy castings

General: The top section of the fuze is centrally threaded for the arming spindle; the middle section houses the clockwork and firing mechanism; and the base section is a simple flat casting added only to afford a means of screwing the plastic booster cup to the fuze. The fuze screws into the bomb with a left-hand thread, and is tightened with a spanner wrench which fits into the two spanner holes in the top of each fuze. Luting on the threads insures a tight,

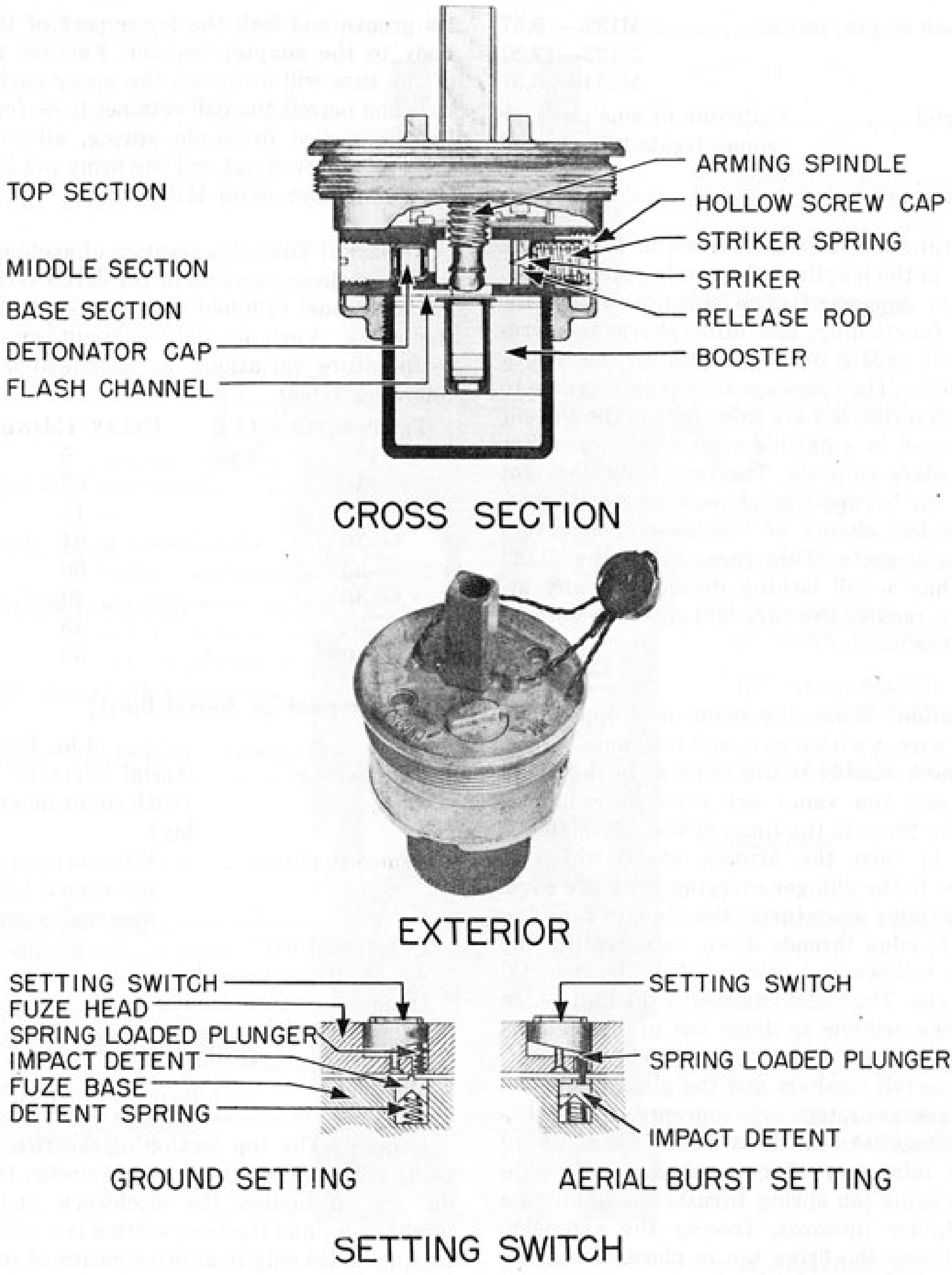


Figure 346. Impact or Aerial Burst Fuze M129

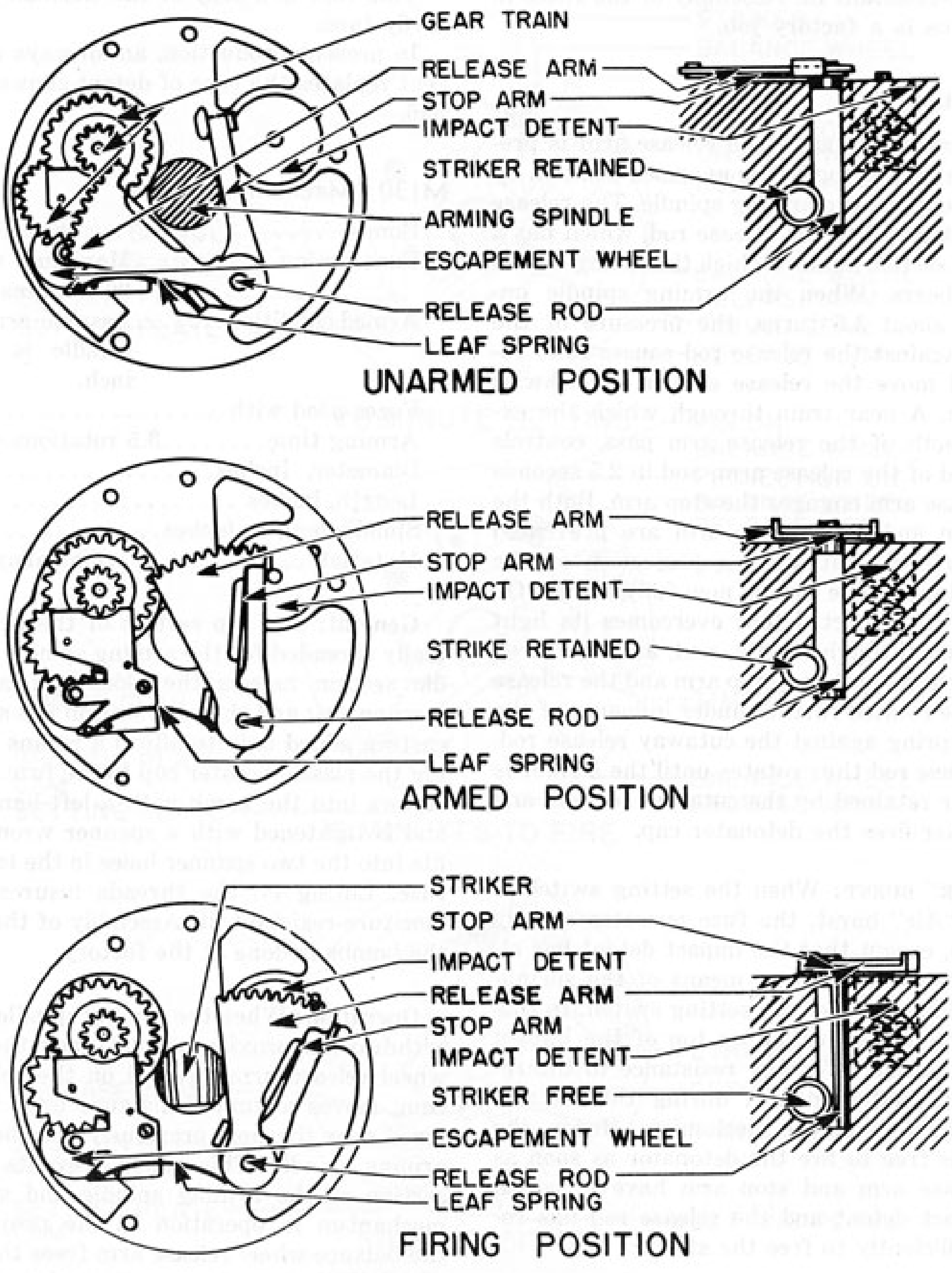


Figure 347. Details of Fuze M129

moisture-resistant fit. Assembly of the fuzes in the bombs is a factory job.

Operation

"GROUND" BURST: The release arm is prevented from moving in the unarmed position by the presence of the arming spindle. The release arm is attached to the release rod, which has a cutaway section against which the spring-loaded striker bears. When the arming spindle unthreads about 3.5 turns, the pressure of the striker against the release rod causes it to rotate and move the release arm in a clockwise direction. A gear train through which the external teeth of the release arm pass, controls the speed of the release arm, and in 2.5 seconds the release arm engages the stop arm. Both the stop arm and the release arm are prevented from further rotation by a projection on the impact detent. The fuze is now fully armed. On impact, the impact detent overcomes its light coil spring through inertia, and, as it is forced down, permits both the stop arm and the release arm to be rotated further under influence of the striker spring against the cutaway release rod. The release rod thus rotates until the striker is no longer retained by the cutaway section, and the striker fires the detonator cap.

"AIR" BURST: When the setting switch is set for "Air" burst, the fuze operates exactly as above, except that the impact detent has already been depressed by means of the spring-loaded plunger under the setting switch. In this condition, the projection on top of the impact detent does not offer any resistance to the release arm and stop arm during their travel across the face of the mechanism. Hence, the striker is free to fire the detonator as soon as the release arm and stop arm have bypassed the impact detent and the release rod has rotated sufficiently to free the striker.

Remarks: This fuze is the only one of the three fuzes for the Bomb M83 which can be identified after it has been inserted in the bomb. Its setting switch, marked "Air-Ground" on top of the fuze, identifies it.

This fuze is a copy of the German (41) butterfly fuze.

In present production, an all-ways action detent replaces the type of detent shown in figure 346.

M130 (Mechanical Time)

Bomb	4-lb. Frag. M83
Functioning	Maximum setting of 30 minutes
Armed condition	Assume armed when spindle is out 0.25 inch.
Fuzes used with	None
Arming time	3.5 rotations of spindle
Diameter, inches	1.75
Length, inches	2
Spindle length, inches	6.5
Material	Zinc alloy castings

General: The top section of the fuze is centrally threaded for the arming spindle; the middle section houses the clockwork and firing mechanism; and the base section is a simple flat casting added only to afford a means of screwing the plastic booster cup to the fuze. The fuze screws into the bomb with a left-hand thread, and is tightened with a spanner wrench which fits into the two spanner holes in the top of each fuze. Luting on the threads insures a tight, moisture-resistant fit. Assembly of the fuzes in the bombs is done at the factory.

Operation: When the arming spindle has been withdrawn approximately 0.25-inch, the balance-wheel release arm, pivoted on the release-arm cam, moves a limited distance until it is centered over the hole previously occupied by the arming spindle. This action prevents the reinsertion of the arming spindle and starts the mechanism in operation as the projection on the balance-wheel release arm frees the balance wheel. With a maximum setting time of 30 minutes, the functioning is as follows:

1. The timing gear, under the influence of its clock spring, rotates in a counterclockwise direction. Near the end of its first revolution, the stud on the timing gear engages the first slot of

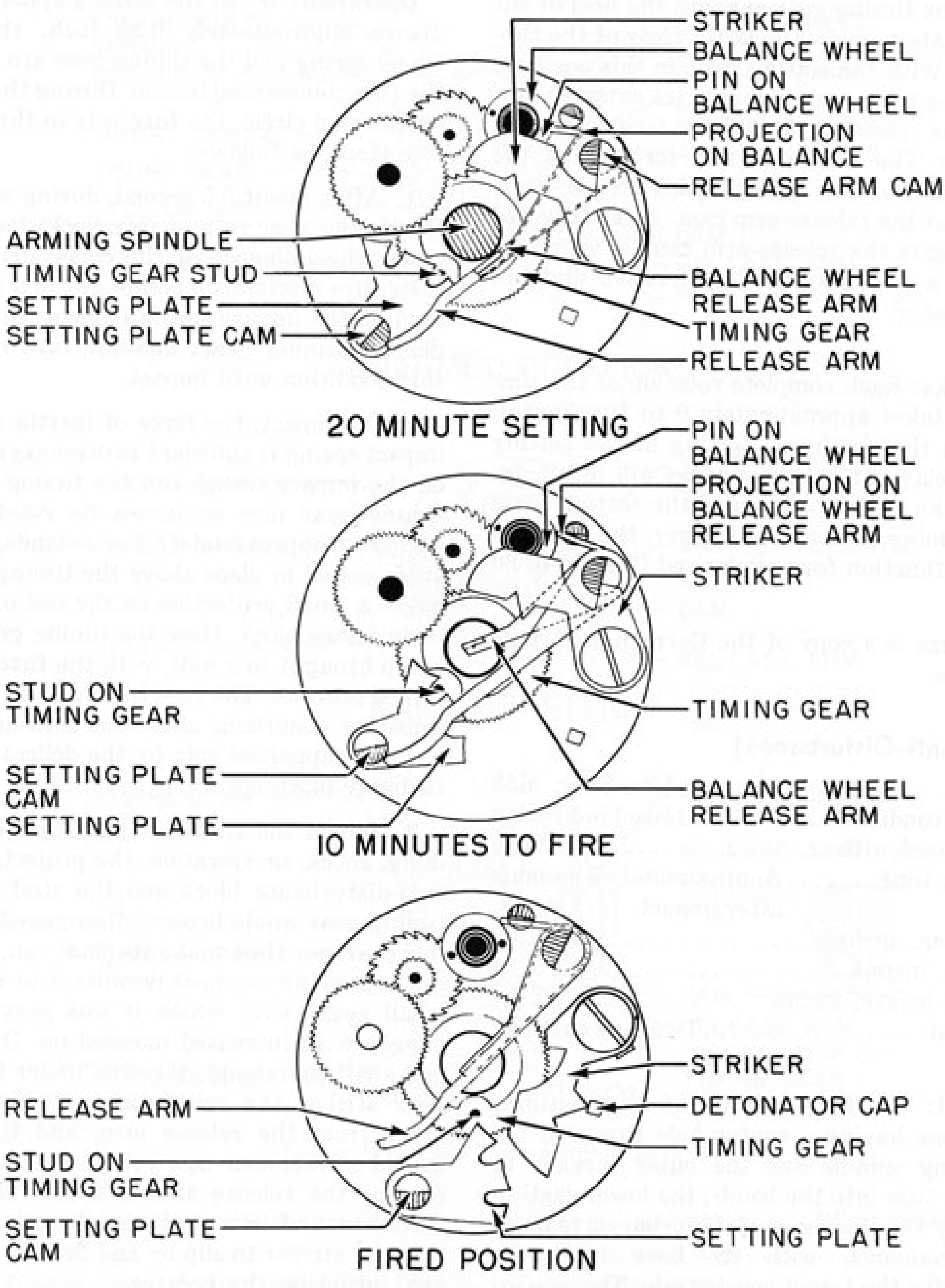


Figure 348. Mechanical Time Fuze M130

the setting plate and pulls the latter around with it a limited distance in a clockwise direction.

2. Near the end of the timing gear's second revolution, the stud engages the second slot in the setting plate, once again moving it a limited distance.

3. Near the end of the third revolution, the

stud on the timing gear engages the heel of the setting plate to move the latter clear of the timing gear. With the setting plate in this position, the setting-plate cam presents its cutaway section to the release arm, thereby freeing the release arm. The release arm is forced past the setting plate by the spring-loaded striker bearing against the release-arm cam. As the pivoted striker clears the release-arm cam, it is free to strike in a counterclockwise direction and fire the detonator.

Remarks: Each complete rotation of the timing gear takes approximately 9 to 10 minutes, and, with the maximum setting of the setting plate, a delay of 27 to 30 minutes will result. By varying the initial position of the setting plate and/or timing gear at the factory, the fuze can be set to function for any desired time up to 30 minutes.

This fuze is a copy of the German (67) butterfly fuze.

M131 (Anti-Disturbance)

Bomb	4-lb. Frag. M83
Armed condition	No external indication
Fuzes used with	None
Arming time	Approximately 5 seconds after impact
Diameter, inches	1.75
Length, inches	2
Spindle length, inches	6.5
Material	Two zinc castings

General: The fuze consists of two castings, the top one having a center hole threaded for the arming spindle and the outer threads to screw the fuze into the bomb; the lower casting containing the timing, anti-disturbance, and firing mechanisms, with its base internally threaded for the tetryl booster cup. The assembly is held together by three long screws. On one side of the lower casting is a large hollow screw which holds the firing pin and the firing-pin spring under compression. Diametrically opposite is another smaller screw retaining the primer detonator.

Operation: When the arming spindle is withdrawn approximately 0.25 inch, the escape-wheel spring and the timing gear are freed, and the fuze commences to arm. During the complete operational circle, the fuze acts in three successive steps, as follows:

1. After about 0.5 second, during which time the timing gear rotates in a clockwise direction under the influence of the coiled drive spring, the entire mechanism is brought to a halt as the stud on the impact spring engages the stud under the timing gear; and the fuze remains in this condition until impact.

2. On impact, the force of inertia on the flat impact spring is sufficient to disengage the studs on the impact spring and the timing gear. The timing gear now continues its rotation for a period of approximately five seconds, until the stud, seated in place above the timing gear, engages a small projection on the end of the anti-disturbance block. Here the timing gear is once again brought to a halt, with the fuze in a fully armed position. The fuze is now in an extremely sensitive condition, since the anti-disturbance block is supported only by the delicate anti-disturbance-block spring.

3. Should the fuze now be subjected to handling, shock, or vibration, the projection on the anti-disturbance block and the stud above the timing gear would become disengaged. The timing gear can thus make its final run, this time until its blank segment permits it to slip by the small gear (with which it was previously engaged) with increased momentum. During this last swift movement, the stud under the timing gear strikes the release-arm stop, moving it away from the release arm, and the spring-loaded striker can now rotate the release-arm cam as the release arm is freed. The cam is forced around in a clockwise direction, permitting the striker to slip by and fire the detonator cap, initiating the booster.

Remarks: There are no markings on the fuze to identify it; and, when fitted into the bomb, it cannot be distinguished from the Fuze M130. This fuze is so sensitive that the vibration caused by an aircraft propeller near by may be

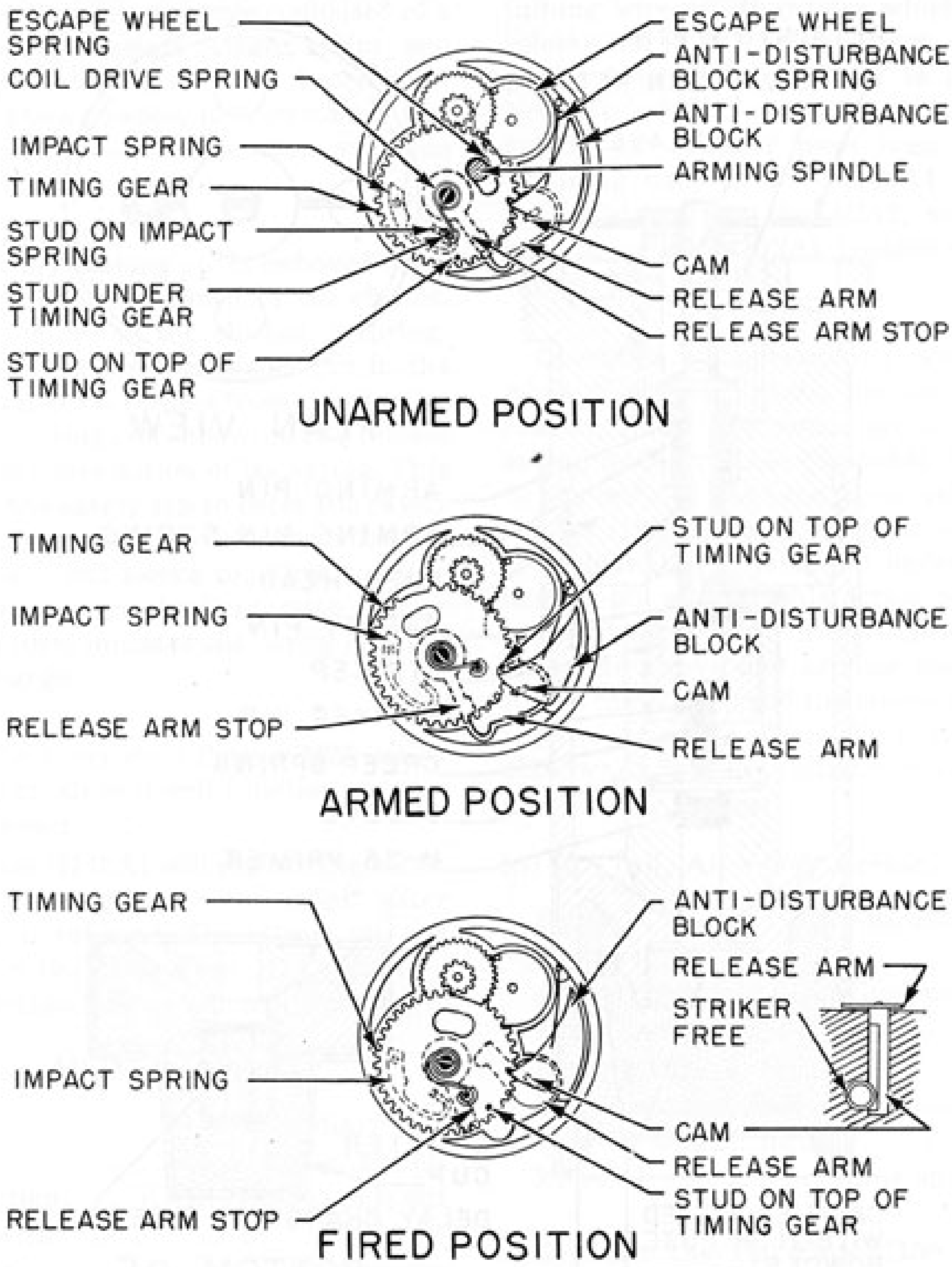


Figure 349. Anti-Disturbance Fuze M131

sufficient to release the anti-disturbance block and fire the fuze.

This fuze is copied from the German (70) B, butterfly fuze.

M142 (M3) (Nose, All-Ways Action Type)

Bomb . . . . 10-lb. Incendiary M74 (NP or PT 1)
Functioning . . . . Instantaneous
Armed condition . . . . . When release pin is out
Fuzes used with . . . . None
Arming time . . . . Instantaneous
Body diameter, inches 1.125
Over-all length, inches 3.250
Material . . . . Steel head, zinc alloy die casting

General: The Nose Fuze M142 supersedes the Nose Fuze M3. The Nose Fuze M3 was used in

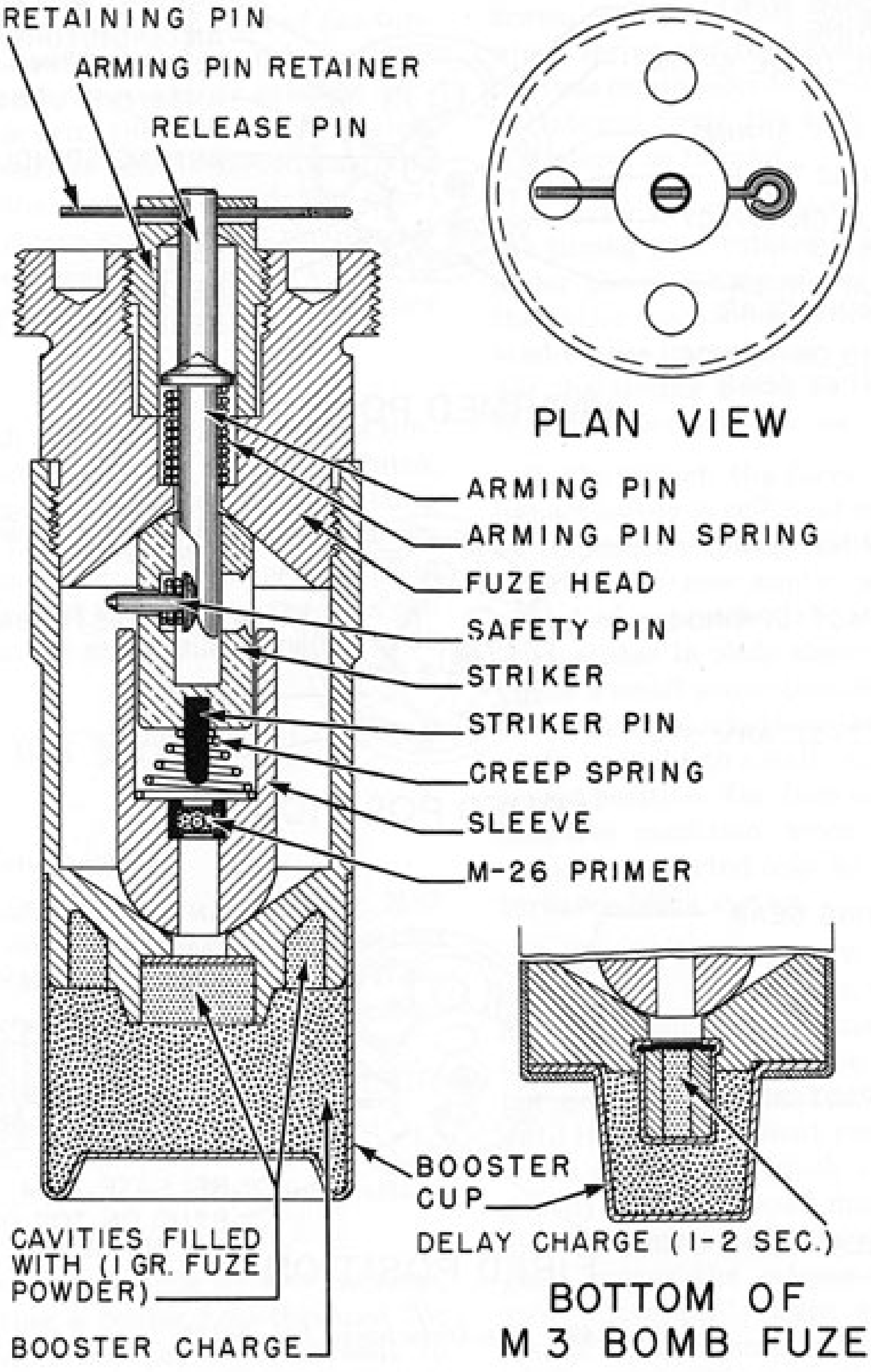


Figure 350. All-Ways Action Nose Fuze M142

experimental production of the M74; however, it was found that the 1 to 2 second delay incorporated in this fuze was unnecessary, as the inherent delay was sufficient. Therefore, it was redesigned and designated the Nose Fuze M142.

The Nose Fuze M142 is an all-ways action fuze which screws into the nose of the bomb. This fuze consists essentially of a steel head and arming-pin retainer, steel striker pin and safety pin; zinc alloy die casting striker, sleeve, fuze casing and arming pin; Percussion Primer M26, cavities in the end of the case filled with one gram of fuze powder, and a zinc booster cup filled with three grams of propellent powder.

The M3 differed in that it had a Percussion Primer M29, built-in delay charge composed of a lead spitter fuze (potassium nitrate, sulfur, and charcoal) capped at both ends by match composition (60% black powder, 40% collodion) and a cellulose nitrate booster cup filled with one gram of fuze powder.

Operation: The retaining pin is removed when the fuzed bombs are assembled in the cluster. While the bombs are in the cluster, a spring-loaded release clip holds the release pin in the body of the fuze. Upon release from the cluster, the release clip springs off, allowing the release pin to jump out under action of its spring. This action permits the safety pin to enter the cavity in the striker, and the fuze is armed. Impact forces the striker and sleeve together, causing the striker pin to pierce the Percussion Primer M26, which, in turn, initiates the cavity charges and booster charge.

Remarks: The Percussion Primer M26 is better than the M29, since it will function even on soft surface impact.

The Nose Fuze M142A1 will replace the M142, because the latter cannot be "re-safed" after the release pin is released. The release pin can be reinserted in the Nose Fuze M142A1. Nose Fuze M142 is reclassified as substitute standard.

M142A1 (Nose, All-Ways Action)

Bomb	10-lb. Incendiary M74
Functioning	Instantaneous
Armed condition	When release pin is out
Fuzes used with	None
Arming time	Instantaneous
Maximum body diameter, inches	1.125
Over-all length, inches	3.25
Material	Steel head, zince alloy die casting

General: The Nose Fuze M142A1 replaces the M142 for use in the 10-pound Incendiary Bomb M74, since the latter cannot be "re-safed" after the release pin is expelled. The M142A1 can be readily re-safed by pushing the release pin back into the unarmed position and inserting the retaining wire or other wire which will hold the release pin in the safe position.

The Nose Fuze M142A1 is similar to the Nose Fuze M142, except that the head and the arming-pin retainer have been changed; two retaining balls in the M142A1 have replaced the safety pin in the M142, and the bottom contour of the M142A1 booster cup is concave rather than flat.

Operation: The retaining wire is removed when the fuzed bombs are assembled in the cluster. While the bombs are in the cluster, a spring-loaded release clip holds the release pin in the body of the fuze. Upon release from the cluster, the release clip springs off, allowing the release pin to jump out under action of the arming-pin spring. This action permits the retaining balls to move inward, freeing the striker from the sleeve and arming the fuze. Impact forces the striker and the sleeve together, causing the striker to pierce the Percussion Primer M26, which, in turn, initiates the cavity charges and booster charge.

M150 (Tail, All-Ways Action)

Bomb	10-lb. Smoke M77 (HC)
Functioning	Instantaneous
Armed condition	When arming pin is out
Fuzes used with	None
Arming time	Instantaneous
Body diameter, inch	1
Over-all length, inches	3.5
Material	Zinc alloy die castings

General: The Tail Fuze M150 is an all-ways action fuze which screws into the tail of the Smoke Bomb M77. This fuze consists essentially of a zinc alloy fuze head, arming pin, striker, striker sleeve, and case, a steel striker pin and safety pin, a Percussion Primer, M26, and a starting mixture enclosed in a zinc cup.

Operation: The retaining wire is removed when the fuzed bombs are assembled in the cluster. While the bombs are in the cluster, their proximity holds an arming band with a

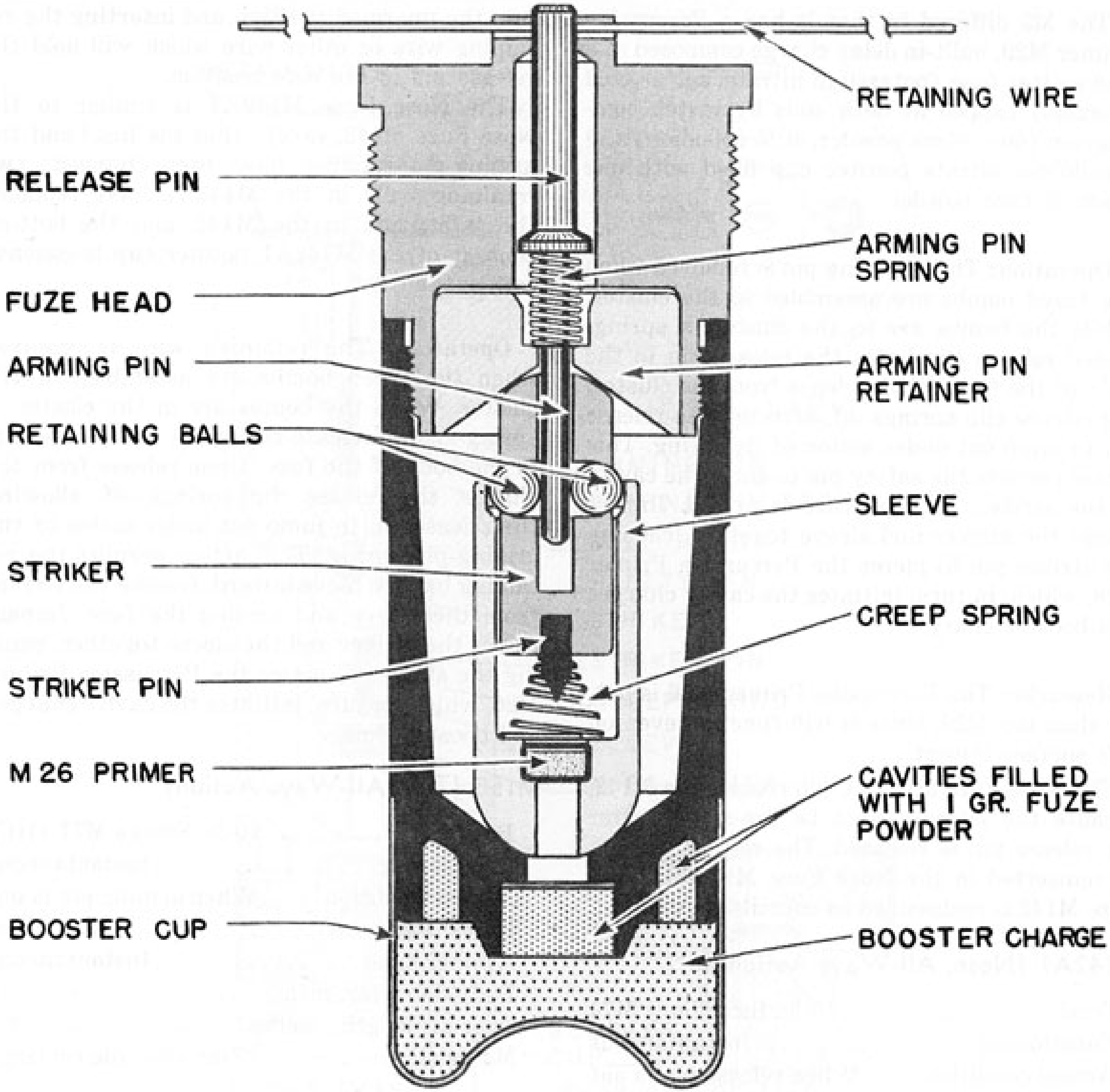


Figure 351. All-Ways Action Nose Fuze M142A1

spring against the head of the fuze, depressing the arming pin. When the bombs are released, the arming pin, together with the arming band, is forced out by the arming-pin spring, permitting the safety pin to enter the cavity in the striker. Impact forces the striker and sleeve together, causing the striker pin to pierce the Percussion Primer M26, which, in turn, ignites the starter mixture, and subsequently the HC smoke mixture.

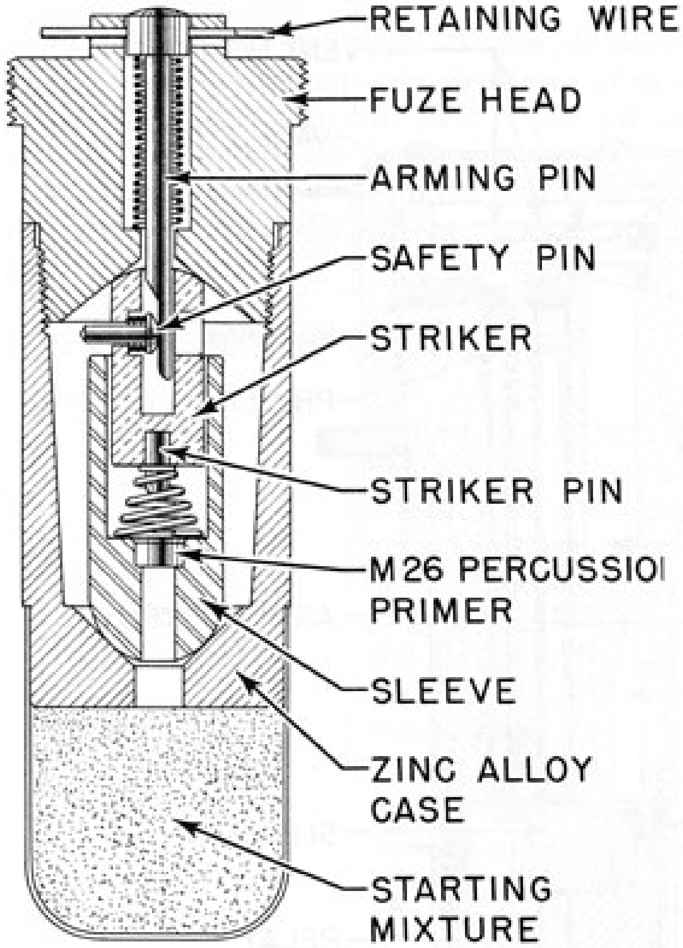


Figure 352. All-Ways Action Tail Fuze M150

M149 (Nose Impact or Blast Pressure)

Bombs.....All bombs receiving AN–M103A1
Armed condition...12 to 13 vane revolutions; release pin out
Fuzes used with......................None
Arming time.....8 to 9 vane revolutions for ejection of release pin; 12 to 13 vane revolutions to arm fully
Vane span, inches....................5.25
Body diameter, inches..................2.5
Over-all length, inches................7.56
Material......Cadmium- or zinc-plated steel

General: The Nose Fuze M149 is a detonator-safe nose fuze. The fuze is designed both for instantaneous action on impact and for air-burst a short distance above the target as a result of the blast wave from the first bomb of a stick of bombs. The first bomb will detonate on impact, while its blast, if of sufficient intensity, will detonate the second bomb, etc., in the air over the target. For example, if 500-pound bombs are dropped in train at 0.05 second intervals at air speed of 200 m.p.h. (14.7-foot spacing) from 10,000 feet, the burst of the second bomb in air will be at a point approximately seven feet ahead of (horizontal separation) the first bomb and 23 feet above (vertical separation) the first bomb. Other bombs in the stick will function the same distances from the bomb which precedes them.

Operation: As the arming wire is withdrawn, the vane cup rotates. After approximately eight or nine turns of the vane cup, the release pin is ejected by its spring. The arming stem rises under pressure of its spring, permitting the detonator slider to align itself below the flash tube. After 12 or 13 turns of the vanes, the vane cup falls off, and the fuze is now fully armed. Bombs fuzed with the Nose Fuze M149 should be released in close train, to take advantage of the air burst feature of the fuze. The first bomb of a stick will detonate on impact with the ground; impact simply snaps the diaphragm to its reversed position, causing the firing pin to strike the primer.

The second bomb of the stick will be detonated by the pressure blast of the first bomb. The blast of the first bomb will cause the diaphragm in the fuze of the second bomb to snap over while the bomb is still in the air a relatively short distance above the target, and thus cause detonation.

Should the diaphragm fail to function for air burst, the fuze can still fire from impact action.

Remarks: When installing the M149, check the vane cup to see that it is free to turn. However, do not unscrew the vane cup, as only a few turns are required to arm the fuze. In the armed condition, the fuze must of necessity be very sensitive.

The fuze is equipped with three expansion chambers, so that, as the diaphragm snaps in, it will not be resisted by an air cushion, which

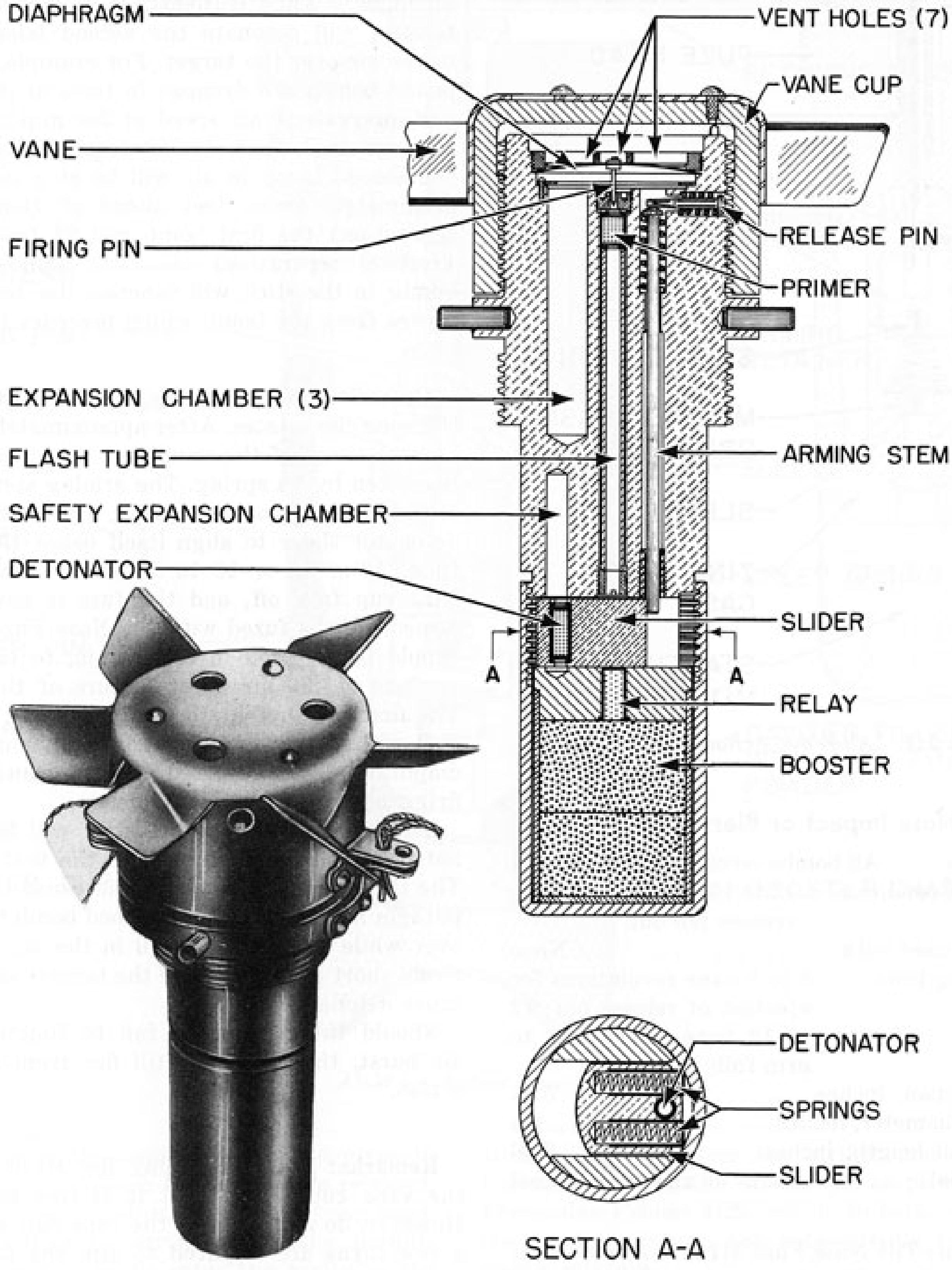


Figure 353. Impact or Blast Pressure Fuze M149

might prevent complete inward movement of the diaphragm.

This fuze is detonator safe. In the unarmed position, the detonator is lined up with the

safety expansion chamber. If the detonator should function prematurely, the force of detonation is dissipated in this cavity, and will not set off the lead-in and booster charges.

Production of the Nose Fuzes M149 has been discontinued, since V.T. fuzes offer more assurance of air burst.

T50E1 and T50E4 (V.T.) (Cancelled)

Bombs

T50E1	100-lb. G.P. AN–M30 250-lb. G.P. AN–M57 2,000-lb. G.P. AN–M66 220-lb. Frag. AN–M88 260-lb. Frag. M81
T50E4	500-lb. G.P. AN–M64 1,000-lb. G.P. AN–M65 500-lb. Chem. AN–M78 1,000-lb. Chem. AN–M79
Functioning	10–40 feet above ground
Armed condition	If vanes are free to rotate, assumed to be armed
Arming time	3,600-ft. min. S.A.T. (some lots of T50E4, 3,100-ft.)
Fuzes used with	AN–M1002 series normally; M160 series
Over-all length, inches	10.4
Body diameter, inches	3.4
Material	Steel body, plastic top, metal ring, steel or plastic vanes

General: These are V.T. fuzes of the ring type. They are designed to detonate the bomb at a point above the earth which will give effective fragmentation. These ring-type fuzes are especially sensitive to "passing objects", and therefore are useful in defoliating by blast and in getting roof-top bursts in city areas.

At the present stage of development, approximately 80 per cent of the fuzes will operate properly upon approach to the target; up to 15 per cent may function spontaneously after arming but before approaching the target; and 5 per cent will be inoperative.

Operation: When the bomb is dropped, the arming wire is pulled, releasing the spring-loaded vane locking pin, which jumps out, freeing the vanes for rotation. The vanes rotate and drive the electric generator and the worm and spur gear reduction train. After the required number of vane revolutions, the detonator lines up with the booster lead-in and at the same time becomes electrically connected to the firing circuit. The rotor detent in the detonator rotor snaps into a hole in the rotor housing, locking the detonator in the armed position and at the same time withdrawing from the keyway in the arming stem. The vanes continue to rotate at high speed, driving the generator, which, in the meantime, has activated the V.T. element and charged the firing condenser. The fuze is now armed. Upon approach to the target under the proper conditions, the V.T. element activates the firing circuit, which discharges the firing condenser through the electric detonator, initiating the explosive train.

Remarks: These fuzes are mechanically interchangeable with the Nose Fuze AN–M103; but are not tactically interchangeable with impact fuzes or with each other. If the V.T. Fuzes T50E1 are used in bomb sizes for which the V.T. Fuzes T50E4 are specified, very low air bursts will result. The same is true for the reverse transposition.

Some lots of the T50E4 cannot accommodate the Air-Travel Arming Delay M1 because of a much heavier steel ring around the vanes. No delayed arming can be accomplished on these lots of fuzes. If a fuze is found with the vane locking pin gone and the vanes free to rotate, it must be considered armed and should not be used.

Vanes may be either ten-bladed steel vanes or three-bladed plastic vanes, interchangeably.

M166 (V.T.)

Bombs	All bombs receiving Fuze AN–M103A1, except Depth AN–Mks 41, 47, 53, 54
Functioning	40–60 feet above ground
Arming time	3,600-ft. min. S.A.T.

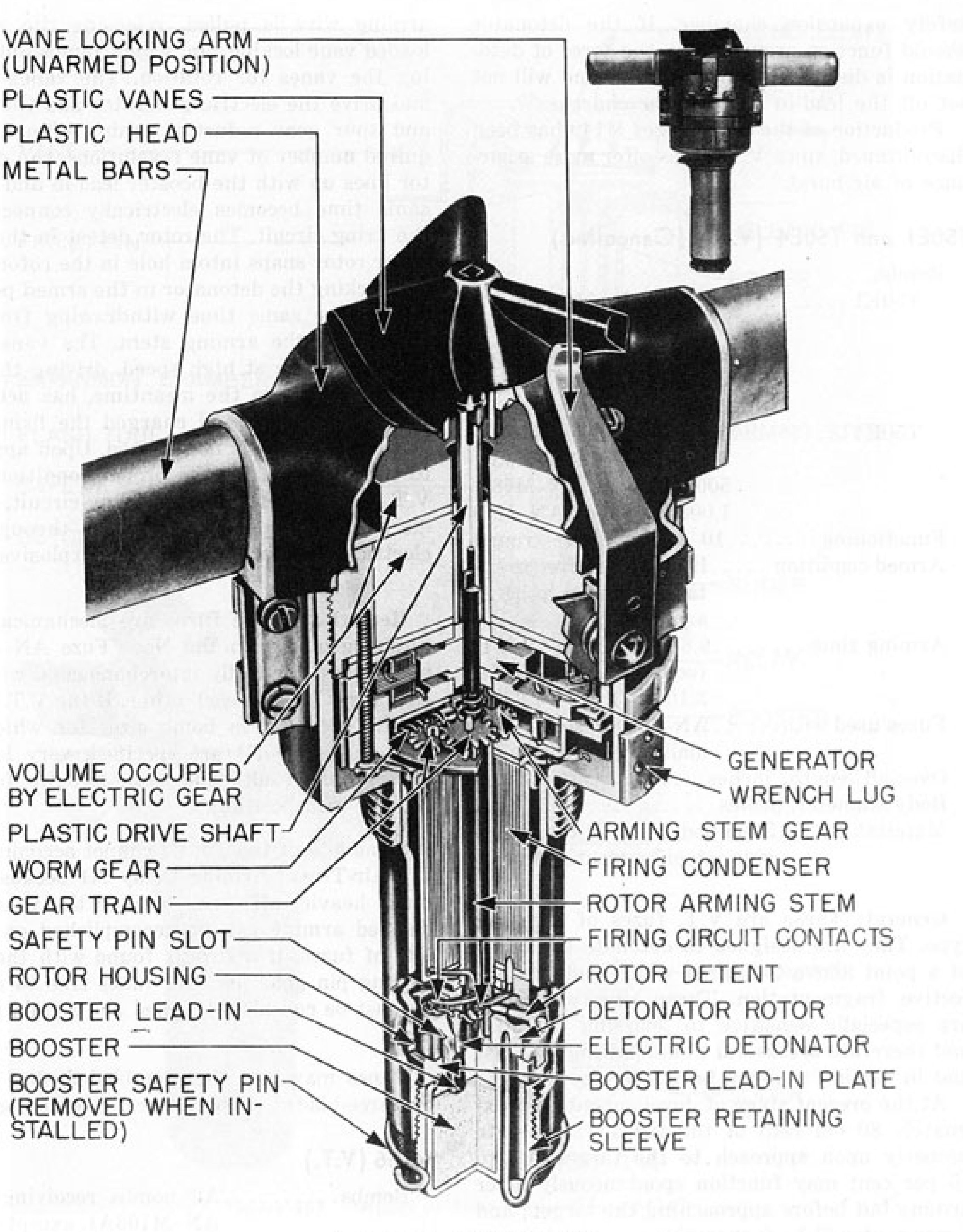


Figure 354. V.T. Fuze M166

Fuzes used with....AN–M100A2 series normally; M160 series
Over-all length, inches................10.4
Body diameter, inches.....10.0 (across bars)
Material ......Steel body, plastic top, two aluminum bars athwartships, plastic vanes

General: This is a V.T. fuze of the bar type. This fuze is more sensitive to head-on approach to a target than the ring type and less sensitive to "passing" objects. It can be used interchangeably in any bomb which will take the Nose Mechanical Impact Fuze AN–M103A1 when air burst is desired, except in the depth bombs noted above, where the air stream does not give sufficient velocity to the vanes because of the flat nose. At the present stage of development, approximately 85 per cent of the fuzes will function properly on approach to the target; a small percentage will be inoperative; and the remainder will function spontaneously after arming but before approaching the target.

Operation: Similar to the T50 type.

Remarks: Arming may be further delayed by use of Air-Travel Arming Delay M1. The device clamps onto a bracket, preventing the vane locking arm from releasing the vanes until the pre-set air travel on the M1 device has been completed.

This fuze has a safety pin running alongside the booster to secure the detonator rotor in the unarmed position. Before installation in a bomb, the safety pin should be removed and reinserted. If it cannot be reinserted, the fuze is armed or partially armed and should be destroyed.

The bars of this fuze should not be used to tighten the fuze into the bomb and should be carefully protected from strain or shock. This fuze is not generally recommended for use in bombs less than 10 inches in diameter, because of the possibility of damaging the bars in "bombing up" the plane and in releasing the bombs. Damage to the bars will cause a malfunctioning of the fuze. A few fuzes of this type were issued as the T51 with a 4,500-foot minimum S.A.T. but with other characteristics identical to the M166 (T51E1).

Modifications now in development on this fuze provide for a sensitivity control switch which will allow for two settings, and a strengthening of the metal bars so that they will stand 400 pounds of torque and allow their being used as a wrench in inserting the fuze.

T91 and M168 (V.T.)

Bombs
M168.............100-lb. G.P. AN–M30
250-lb. G.P. AN–M57
220-lb. Frag. AN–M88
260-lb. Frag. M81
2,000-lb. G.P. AN–M66
Functioning........30–60 feet above ground when released below 8,000 feet.
Armed condition......If vanes are free to rotate, assumed to be armed unless safety pin can be inserted
Arming time
T91.................2,000 ft. min. S.A.T.
Fuzes used with.....AN–M100A2 series normally; M160 series
Over-all length, inches................10.4
Body diameter, inches..................3.4
Material.......Steel body, plastic top, metal ring, steel or plastic vanes

General: This is a V.T. fuze of the ring type, similar to the T50E1 series. The V.T. Fuzes T91 differ from the T50E1 group in that they have greater sensitivity and are specially designed to be used for low-level, medium-level, dive, and toss bombing. These ring-type fuzes are especially sensitive to "passing" objects and therefore are useful in defoliating by blast and in getting roof-top bursts in city areas.

At present, about 85 per cent will operate properly upon approach to the target; 5 to 10 per cent may function spontaneously after arming, and 5 per cent will be inoperative. These fuzes have minimum S.A.T. reduced to 2,000 feet for use in low, medium, dive, and toss

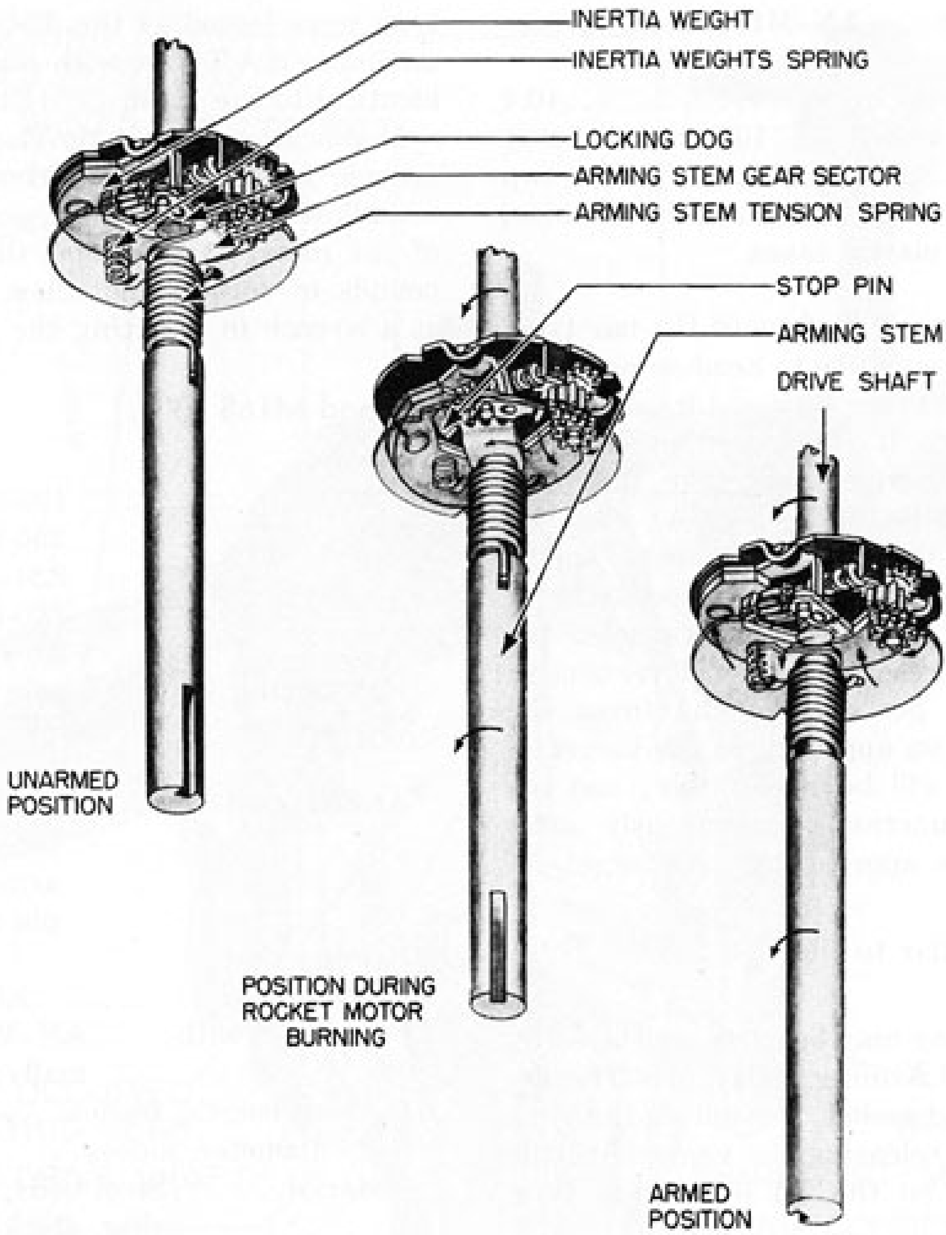


Figure 355. V.T. Fuze M168—Arming Device

bombing. S.A.T. can be extended by use of the Air-Travel Arming Delay M1.

Operation: Like the T50 series.

Remarks: These fuzes are not to be used for horizontal bomb runs, because the minimum S.A.T. is such that the fuzes may be completely armed when only 250 feet below the carrying aircraft, and early bursts in this position would cause damage to the plane.

T82 (V.T.) (Cancelled)

Bombs................All bombs receiving Fuze AN–M103A1
Functioning........40–60 feet above ground
Arming time...........3,600 ft. min. S.A.T.
Fuze used with......AN–M100A2 series normally; M160 series
Over-all length, inches.................8.4
Body diameter, inches.....10.0 (across bars)
Material.......Steel body, plastic top, two aluminum bars athwartships

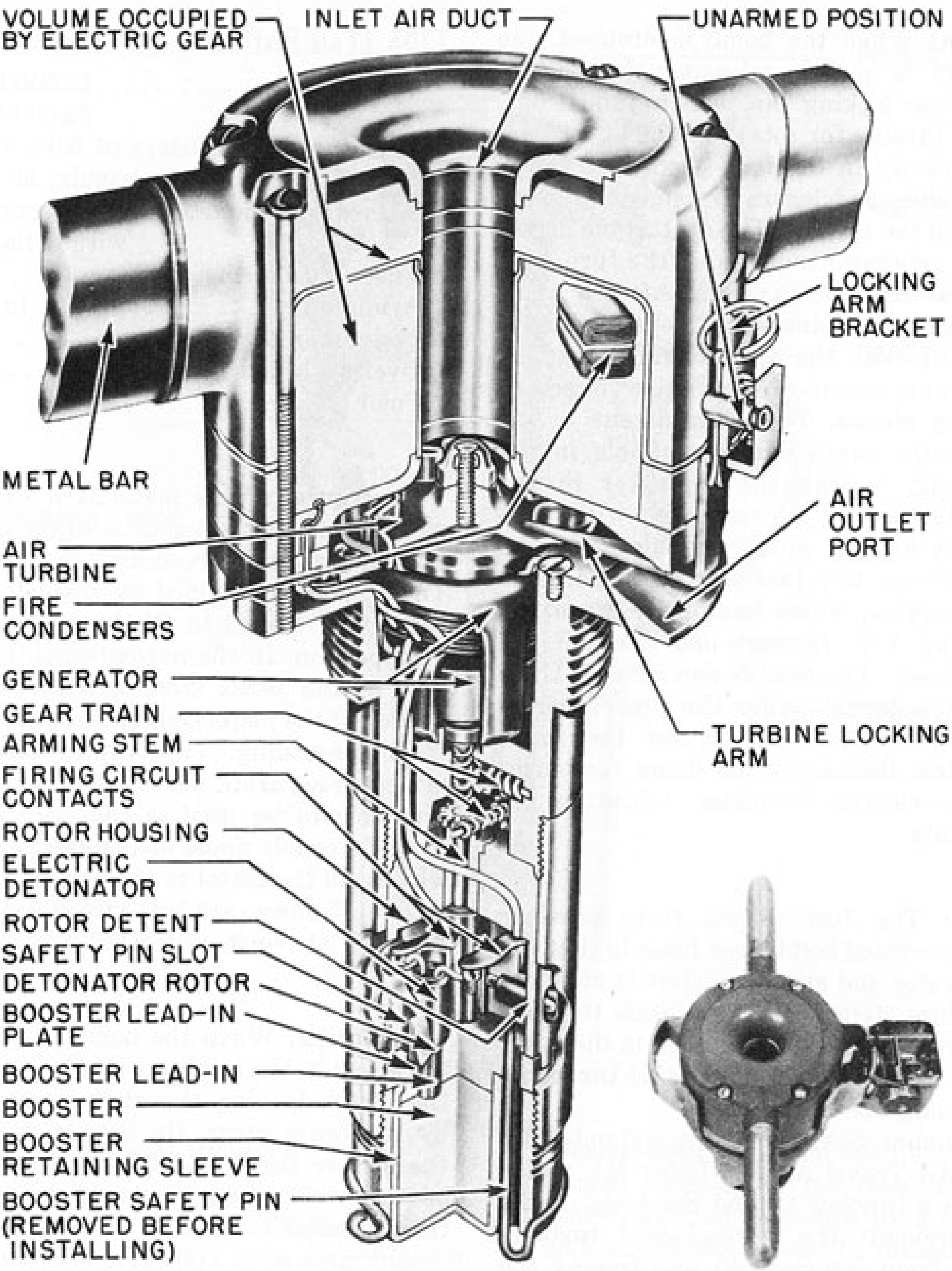


Figure 356. V.T. Fuze T82

General: This is a V.T. fuze of the bar type. This fuze, like the V.T. Fuze M166, is more sensitive to head-on approach to a target than the ring type and less sensitive to "passing" objects. It can be used interchangeably in any bomb which takes the Nose Mechanical Impact Fuze AN-M103A1 when air burst is desired. At the present stage of development, approximately 90 per cent of the fuzes will function properly upon approach to the target, and the remainder either will function spontaneously after arming but before approaching a target, or will be inoperative.

Operation: When the bomb is dropped, the arming wire is pulled, releasing the spring-loaded turbine locking pin, which jumps out, freeing the turbine for rotation. The air stream enters the cavity in the fuze head, blows over the air turbine, and leaves through the lower ports, around the turbine. The air turbine drives the electric generator mounted in the fuze stem and the gear reduction system. After a minimum number of turbine revolutions, the detonator lines up with the booster lead-in and, at the same time, becomes electrically connected to the firing circuit. The rotor detent in the detonator rotor snaps out into a hole in the rotor housing, locking the detonator in the armed position and at the same time withdrawing from the keyway in the arming stem. The turbine continues to rotate at high speed, driving the generator, which has in the meantime activated the V.T. element and charged the firing condenser. The fuze is now armed. Upon approach to a target under the proper conditions, the V.T. element activates the firing circuit, which discharges the firing condenser through the electric detonator, initiating the explosive train.

Remarks: The fuze differs from previous generator-energized bomb nose fuzes in that the entire generator and arming system is mounted inside the fuze stem, which fits inside the fuze well. The firing condenser is carried in that part of the body section which is outside the bomb and will usually be demolished.

The minimum S.A.T. may be extended by use of the Air-Travel Arming Delay M1, which clamps onto a bracket around the body of the fuze and prevents the spring-loaded turbine-locking pin from jumping out and freeing the turbine until the pre-set air travel of the M1 device has been completed.

The booster safety pin in this fuze locks the detonator rotor in the unarmed position. Before installation of the fuze in a bomb, the pin should be pulled and reinserted. If it cannot be reinserted, the fuze is armed or partially armed and should be destroyed.

T708 (Tail Pistol)

Bombs	12,000-lb. G.P. T10 22,000-lb. G.P. T14
Functioning	Delays of 0.05, 0.25, 0.5, 3.0, 11.0 seconds; 30, 60 minutes
Armed condition	Safety pin and arming wire withdrawn
Fuzes used with	None
Arming time	Instantaneous
Body diameter, inches	2
Over-all length, inches	3-7/8
Color	Brass

Description: This pistol is a simple impact mechanism consisting of a brass body with a central channel to accommodate a heavy striker. The striker is retained by a small brass cross which is fastened to the top of the striker by a copper pin. In the normal condition, the four tabs of the brass cross extend outward over the top of the pistol body, preventing the striker from descending. Two arming-wire holes are drilled in separate planes at 90° to each other. The hole to be used is that which gives the more favorable angle of pull-off for the arming wire from the pistol to the fuzing unit. Parallel to one of these arming wire holes, and about 1/4 inch above it, is located a safety-pin hole.

Operation: When the bomb is released from the aircraft, the arming wire is withdrawn from the pistol, leaving the striker supported only by the brass cross. On impact, the inertia of the striker bends the tabs of the brass cross, allowing the striker to move forward and pierce the detonator.

Remarks: The use of this pistol is restricted to high-level bombing operations, as there is danger of non-functioning from low altitudes.

Three of these pistols, located 120° apart in the base plate, are used with the 12,000-pound G.P. bomb.

The striker used with this pistol is of the needle type; thus only sensitive-type detonators can be used.

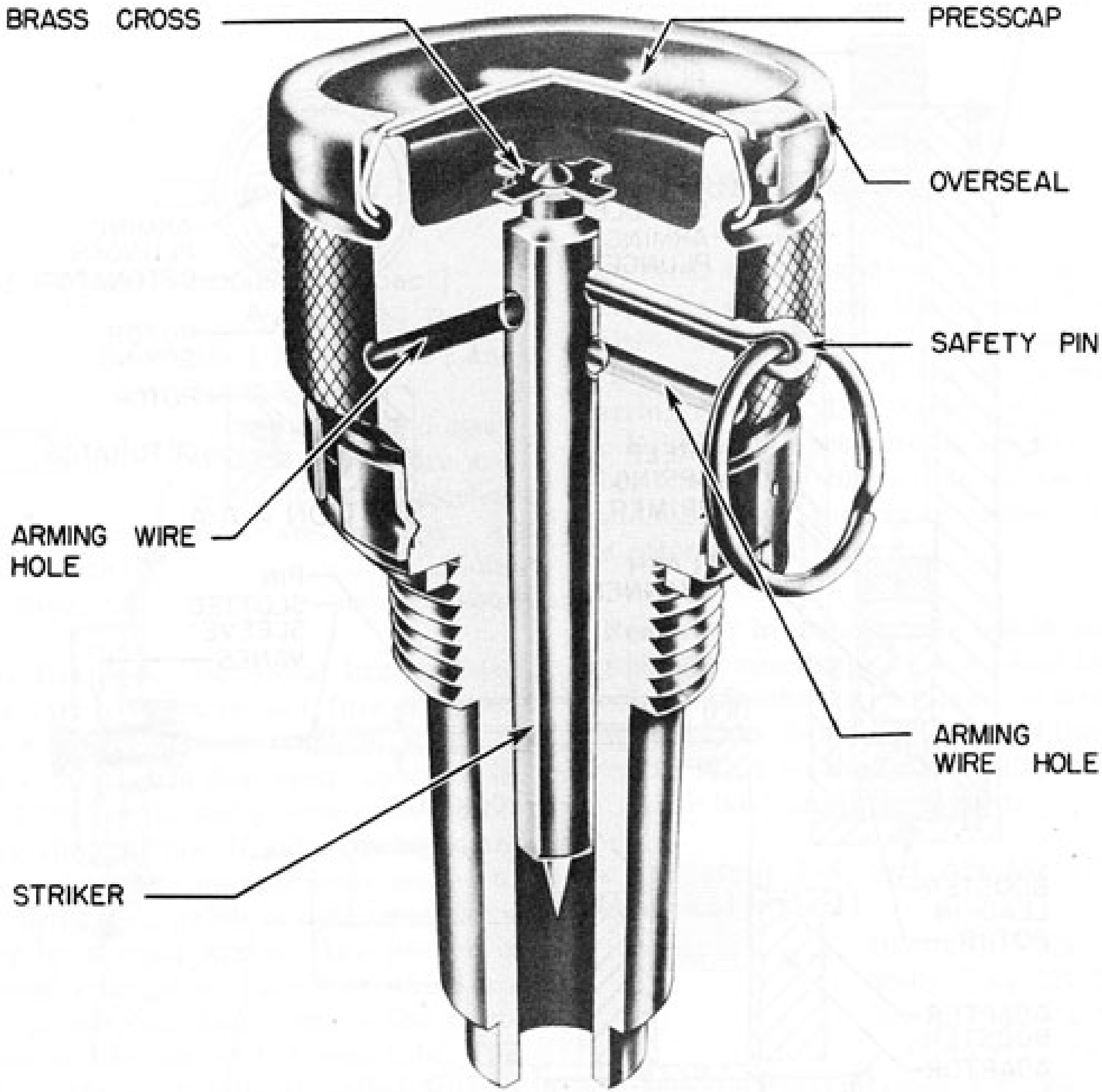


Figure 357. Tail Pistol T708

T723 (Tail Mechanical Impact)

Bombs............12,000-lb. T10; 22,000-lb. T14 (3 T723's in tail)

Functioning......Delays to be determined in tests; will depend on mission

Armed condition.......When arming spindle is out of fuze; no external evidence

General: The Tail Mechanical Impact Fuze T723 is designed as a replacement for the Pistol T708 (British No. 58) in the G.P. Bombs T10 and T14, to provide air-travel arming.

Description: This fuze has its windmill vanes mounted outside the tail cone, and connected to the fuze arming spindle by a slotted sleeve, which allows the spindle to thread out into the slot. The fuze is detonator safe, the detonator being housed in a rotor which lines up after the arming spindle is out of the fuze. A larger auxiliary booster is used with this fuze, because of the size of the bomb.

Operation: The shipping plug is removed when the fuze is inserted in the bomb. Release from the plane pulls the arming wire and allows the vanes to start rotating. They thread

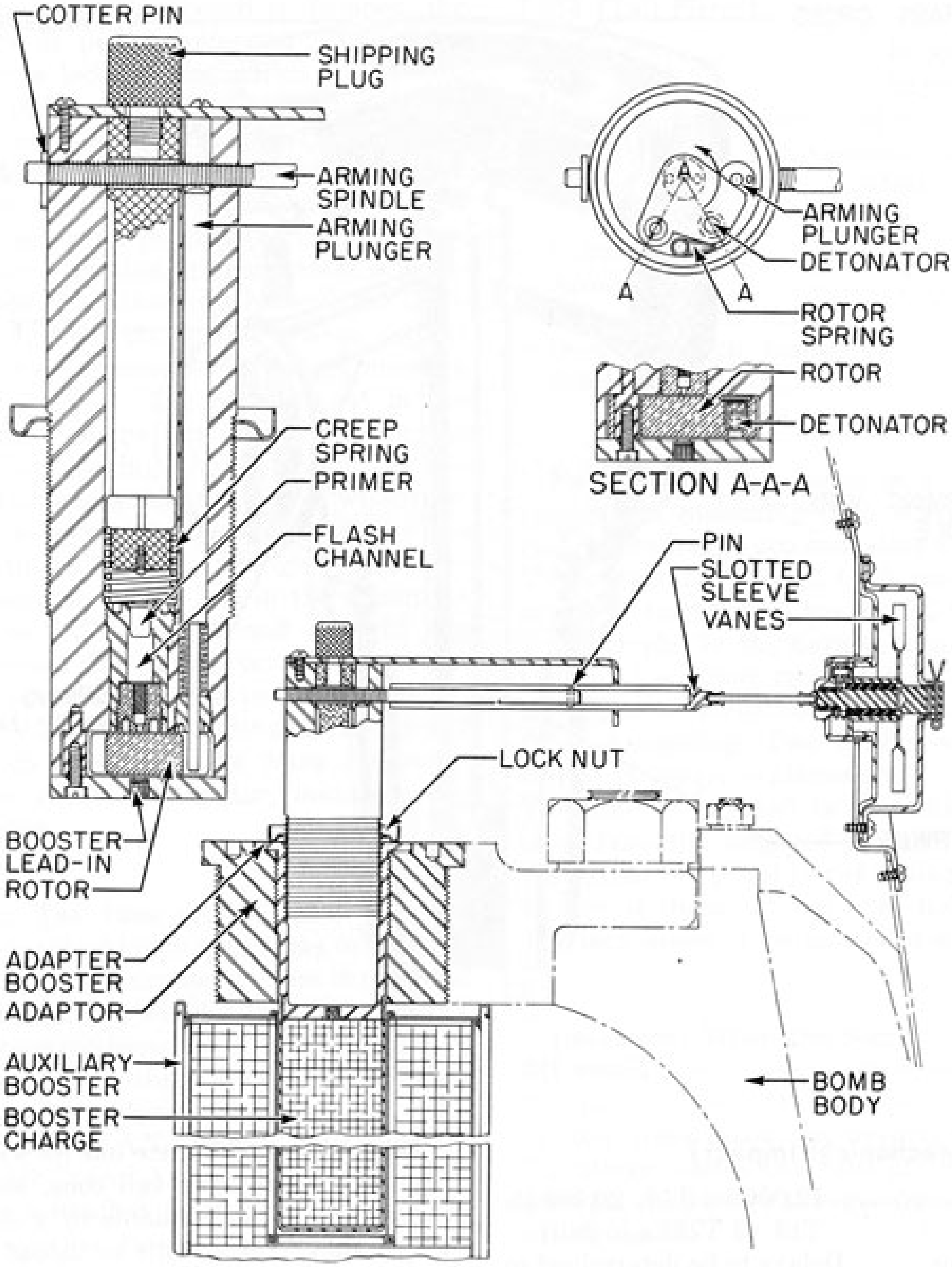


Figure 358. Tail Fuze T723

the arming spindle out, the spindle's connecting pin riding up the groove in the slotted sleeve. When the spindle is out, the spring-loaded plunger moves up, freeing the rotor, which is turned by its spring until the detonator is in position under the delay pellet. The rotor spring then acts as a lock to hold it in position. The fuze is now armed, and on impact the heavy inertia weight will overcome the creep spring and strike the primer, which will set off the delay pellet and then the detonator.

NAVY-DESIGNED BOMB FUZES

Mk 3 Mod 1 (Nose Mechanical Impact)

Bombs.............Floating Smoke Bombs Mk 1 Mods 1 and 2 and Mk 3 Mod 0
Functioning ....18-second delay
Armed condition....When arming wire and spring-loaded horseshoe collar are removed
Fuzes used with.....................None
Arming time................Instantaneous

General: The Nose Mechanical Impact Fuze Mk 3 Mod 1 is a water impact fuze designed as an integral part of each bomb in which it is used. It consists of a fuze body, mounted in the nose of the bomb, and a vent-tube assembly running through the HC filler of the bomb. A washer in front of the fuze body serves to retain the firing pin, which is held away from the primer by a creep spring. The primer is mounted over a length of time fuse which extends to a quick match increment in the starting mixture at the rear of the vent tube. The after end of the vent tube is sealed with a blow-out disc.

The Adapter Mk 1 is attached to the protruding fuze body to ensure fuze functioning on either water or land impact. The adapter, which is attached to the protruding body by three set screws, consists of a cup-shaped head mounted on a freely moving plunger. The plunger, which is held in its guide by two stop screws, will transmit any blow on the cup to the firing pin. A spring-loaded horseshoe collar is mounted beneath the cup to hold the plunger away from the firing pin.

Operation: Upon release of the bomb, the arming wire is pulled, releasing the spring-loaded horseshoe collar, which falls away from the adapter. The fuze is then armed. On impact with either land or water, the plunger drives the striker into the primer. The primer ignites the time fuse, which burns for 18 seconds and then sets off the quick match and starting mixture. The starting mixture ignites the HC filler. As pressure builds up in the vent tube, the seal is blown out. Since the bomb floats nose-down, the smoke passes out through the after end of the vent.

Remarks: In using smoke bombs for screening landing operations, it was found that a fair number of bombs were dropped on land and the fuze did not function. The addition of the Adapter Mk 1 ensured functioning of the fuze on either land or water impact.

Mk 219 Mods 2–4, and AN–Mk 219 (Nose Mechanical Impact)

Bombs...........100-lb. G.P. Mk 4 Mods
30-lb. Frag. Mk 5
500-lb. G.P. Mk 12 Mods
1,000-lb. G.P. Mk 13 Mods
500-lb. L.C. Mk 9
1,000-lb. L.C. Mk 9
100-lb. Chemical Mk 42
All types of depth bombs
Functioning ....Instantaneous
Armed condition....When striker flange has risen more than 0.31 in. from outer sleeve, and arming wire is gone
Fuzes used with....Mk 223 in G.P. bombs, or Mks 224,234,229,or AN–Mk 230 in depth bombs
Arming time...........170 vane revolutions
Vane span, inches...........4.75 (4 vanes)
Body diameter, inches.................2.75
Over-all length, inches.................5.5
Material.............Steel, aluminum alloy, and brass parts

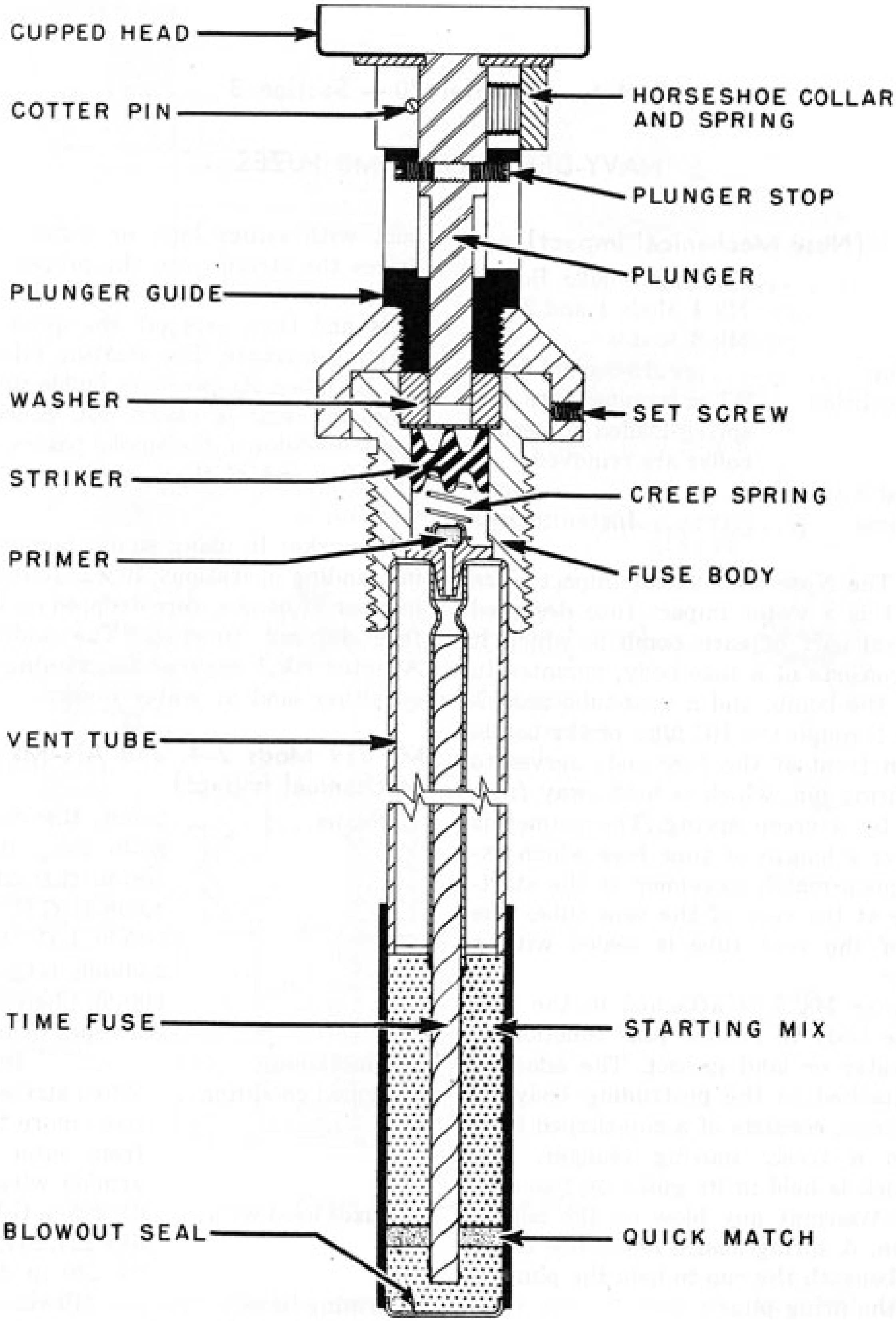


Figure 359. Nose Fuze Mk 3 Mod 1

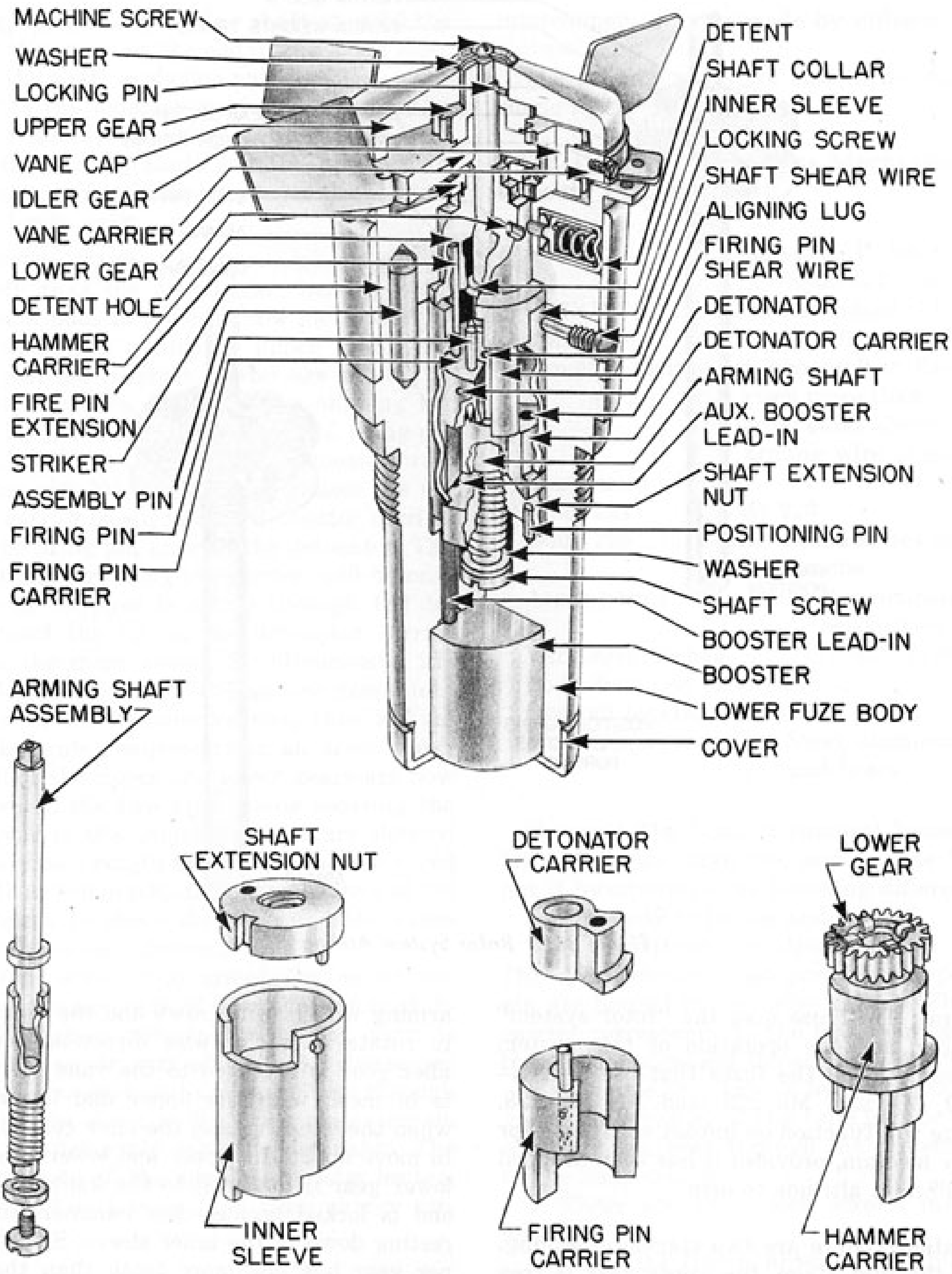


Figure 360. Nose Fuze AN–Mk 219

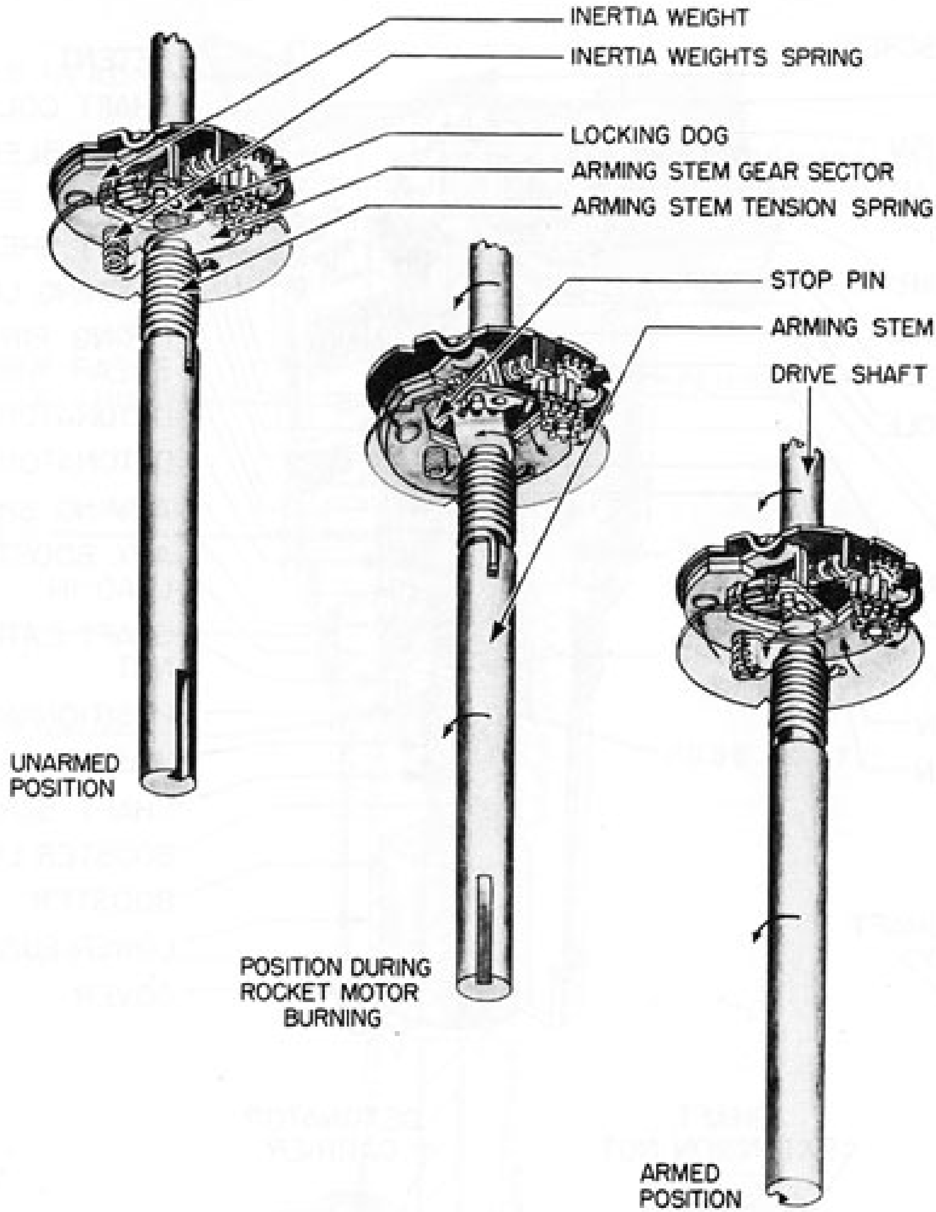


Figure 361. Rotor System Arming

General: This fuze uses the "rotor system" of arming, and the operation of this system is the same in all the fuzes that use it: AN–Mk 219, Mk 221, Mk 223, and AN–Mk 228. This fuze will function on impact with water or a denser medium, provided it has been dropped from sufficient altitude to arm.

Operation: There are two stages of arming. During the first stage, the upper gear is free to rotate and the lower gear is held stationary. During the second stage, the lower gear is free to rotate and the upper gear is held stationary.

FIRST STAGE: As the bomb is dropped, the arming wire is withdrawn and the vanes begin to rotate in a clockwise direction. Since the idler gear is attached to the vane carrier and is in mesh with the upper and lower gears, when the vanes rotate, the idler gear is caused to move about the upper and lower gears. The lower gear is attached to the hammer carrier, and is locked because the hammer carrier is resting down in the inner sleeve. Since the upper gear has one more tooth than the lower gear, the upper gear will rotate in a clockwise direction, one tooth for every complete revolution of the idler gear. The upper gear is positively attached to the arming shaft, and, in

rotating, threads the arming shaft up until the head of the screw on the end of the shaft locks against the shaft extension nut. A collar on the shaft lifts the hammer carrier and the entire arming assembly. Simultaneously with the locking of the arming shaft and the upper gear, the hammer carrier clears the inner sleeve, freeing the lower gear.

SECOND STAGE: The lower gear has one less tooth than the upper gear; hence, as the pinion continues to revolve (now meshing with the teeth of the stationary upper gear), the lower gear and hammer carrier are rotated in a counterclockwise direction. The aligning lug on the hammer carrier engages the firing-pin carrier, lining up the firing-pin extension with the firing pin. Further rotation causes the firing-pin carrier to engage the detonator carrier, lining the firing pin up with the detonator. The hammer carrier, firing-pin carrier, and detonator carrier continue to rotate through 180 degrees, until the lip on the detonator carrier engages the inner sleeve. Simultaneously, the spring-loaded detent in the striker snaps into a recess in the hammer carrier, thus locking the firing-train components in an armed position. Since the upper and lower gears are now both locked, the two copper pins securing the lower gear to the hammer carrier are sheared and the vanes rotate freely. (If the air speed is less than 300 m.p.h., the air pressure will not be sufficient to shear the pins, and the vanes will merely cease rotating.)

The fuze is now fully armed. On impact, the entire upper assembly of the fuze is forced inward. The shear wire in the arming shaft is cut as the upper part of the shaft telescopes into the lower part, and the shear wire through the firing pin is cut as the firing-pin extension forces the firing pin into the detonator. The detonator sets off the auxiliary booster lead-in, booster lead-in, booster, and main charge successively.

Remarks: The early Mk 219, Mods 2, 3, and 4 are identical to the AN–Mk 219. The different Mods merely indicated the manufacturer of the fuze. This was important only in that slight differences in the manufacture prevented the interchange of parts made by different manufacturers.

The internal parts are held in the fuze by a single master locking screw.

Mk 221 and Mk 239 (Nose Mechanical Impact) (Obsolescent)

Bombs
- Mk 221 ....500-lb. G.P. Mk 12; 1,000-lb. G.P. Mk 13
- Mk 239 ....AN–standard G.P. bombs

Functioning ....0.01 second delay

Armed condition ..When striker flange has risen more than 5/16 inch from outer sleeve, and arming wire is gone

Fuzes used with
- Mk 221 ....Mk 223
- Mk 239 ....AN–M100 series in AN–M G.P. bombs

Arming time ....Approximately 150 revolutions

Vane span, inches ....5.3 (four vanes)

Body diameter, inches 2.75

Over-all length, inches 8.5

Material ....Steel, aluminum alloy, and brass

General: The Nose Mechanical Impact Fuze Mk 221 is essentially the same as the Mk 219, but it incorporates the following differences:

1. The body is longer and larger.
2. It incorporates a delay of 0.01 second. The delay element and percussion-type firing pin are housed in the delay carrier. The delay carrier corresponds to the firing-pin carrier in the Nose Mechanical Impact Fuze Mk 219.
3. A protecting cap is over the head. The vanes are screwed to the vane carrier by four screws which pass through the protecting cap to the vane carrier.
4. There are three lock screws instead of one.
5. When the fuze is armed, a lock pin in the floor of the fuze body falls through an opening in the shaft extension nut, locking the rotor and the delay carrier to the shaft extension nut, and thus preventing the parts from getting out of line before impact.

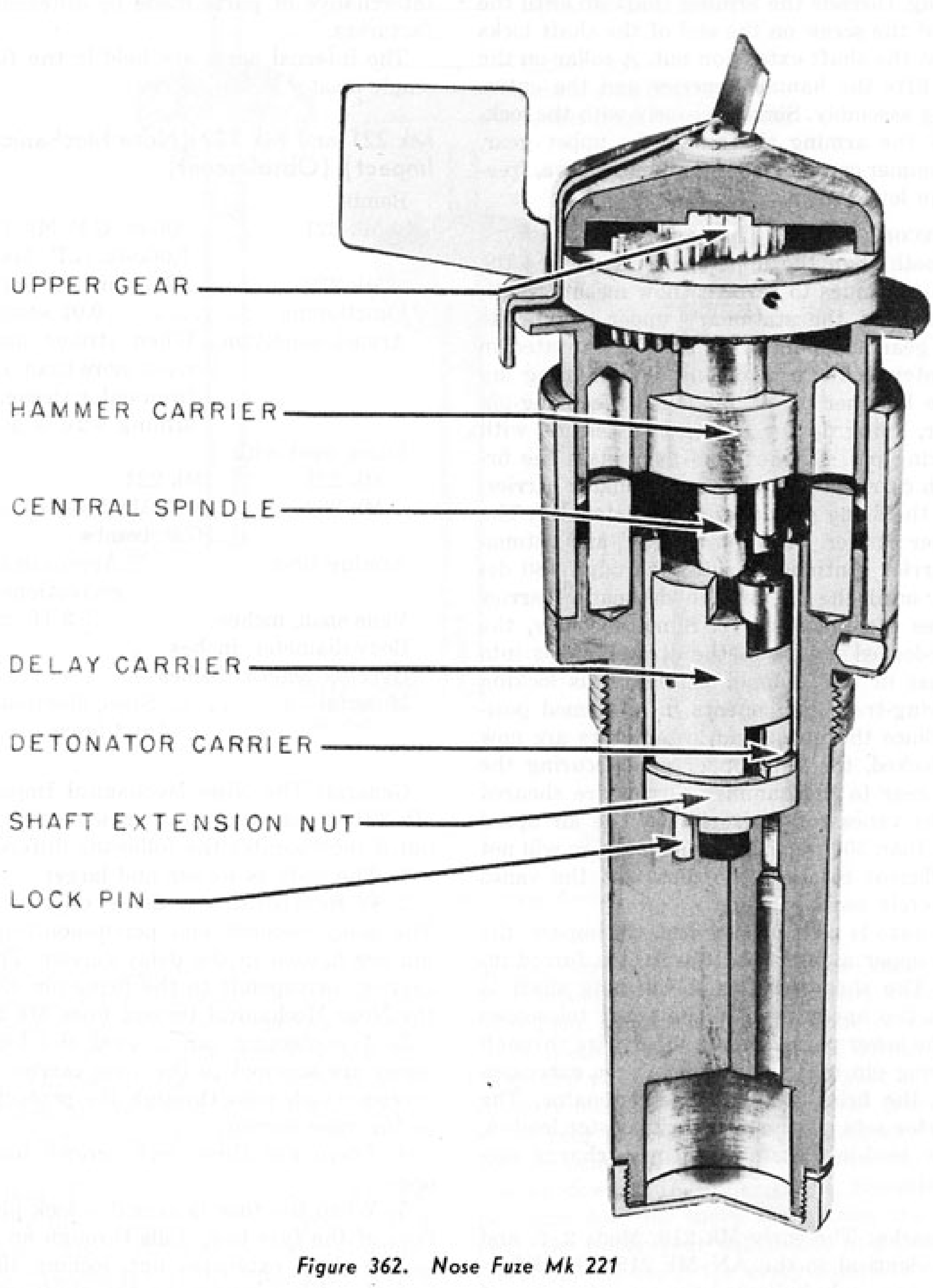


Figure 362. Nose Fuze Mk 221

6. The central spindle has a shear collar and a guide pin which permit the central spindle to telescope. The Nose Mechanical Impact Fuze Mk 239 is a Fuze Mk 221 modified by reducing

the diameter of the fuze (extending from the booster cup to the fuze threads) from 1,875 inches (Mk 221) to 1.59 inches. The Mk 239 was designed to utilize present stocks of Fuzes Mk 221 in AN–standard G.P. bombs.

Operation: The operation of the Mk 221 and Mk 239 is the same as the operation of the AN–Mk 219.

Remarks: The delay element consists of a primer, a delay pellet of black powder, and a special detonator of fulminate of mercury; the detonator consists of fulminate of mercury mixture; and the auxiliary booster lead-in, booster lead-in, and booster consist of tetryl.

The Mk 221 will fit into the nose of the depth bomb, but the 0.01 second delay may allow the case of the bomb to be so damaged that a low-order detonation may result. Therefore, it is not recommended that the Mk 221 be used with the depth bomb.

Mk 223 (Tail Mechanical Impact) (Obsolescent)

Bombs........500-lb. G.P. Mk 12 and Mods; 1,000-lb. G.P. Mk 13
Functioning..............0.01 second delay
Armed condition.....When striker has risen over 5/16 inch above outer sleeve, as seen through window in aluminum casing
Fuzes used with......AN–Mk 219 or Mk 221
Arming time..........150 vane revolutions
Vane span, inches...........5.25 (16 vanes, unpainted)
Body diameter, inches.................3.25
Over-all length, inches...............16.36
Material.....Cast-aluminum case; fuze parts are steel, aluminum alloy, and brass

General: The fuze is essentially a Mechanical Impact Fuze Mk 221 with an external protective bottle-shaped casing of aluminum, a vane extension shaft, and 16 vanes instead of four. This casing screws onto the fuze body and is secured by two lock screws. The lower end of the vane shaft has a flattened surface and fits into a slot in the top of the fuze cap, which is attached by screws to the pinion carrier. The fuze has a delay element in the delay carrier similar to the Mk 221; and a celluloid window in the protective casing permits inspection of the fuze to determine whether or not it is in the armed condition.

Operation: When the arming wire is withdrawn, the arming vanes and the vane shaft rotate. The lower end of the vane shaft engages the cap, which rotates and revolves the pinion around the inner gears, operating the reduction gearing. The alignment of the firing-pin extension, delay carrier (firing-pin carrier in AN–Mk 219), and detonator is similar to that of the Nose Mechanical Impact Fuze AN–Mk 219.

Remarks: The central spindle in this fuze does not telescope, but the collar on the central spindle which supports the hammer carrier is held by a shear wire which breaks on impact as the cap, vane carrier, and striker move forward under the influence of inertia.

The delay element consists of a primer, a delay pellet of meal "D" black powder, and a special detonator of fulminate of mercury mixture; and the auxiliary booster lead-in, booster lead-in, and booster consist of tetryl.

The moving parts housing the firing train are held in the fuze by three locking screws.

AN–Mk 228 (Tail Mechanical Impact)

Bombs..........1,000-, 1,600-lb. A.P. bombs
Functioning..............0.08 second delay
Armed condition..When striker flange has risen more than 5/16 inch above outer collar, as seen through celluloid window
Fuzes used with.....................None
Arming time......150–160 vane revolutions
Vane span, inches..........5.25 (16 vanes, painted red)
Body diameter, inches.................3.15
Over-all length, inches...............16.36

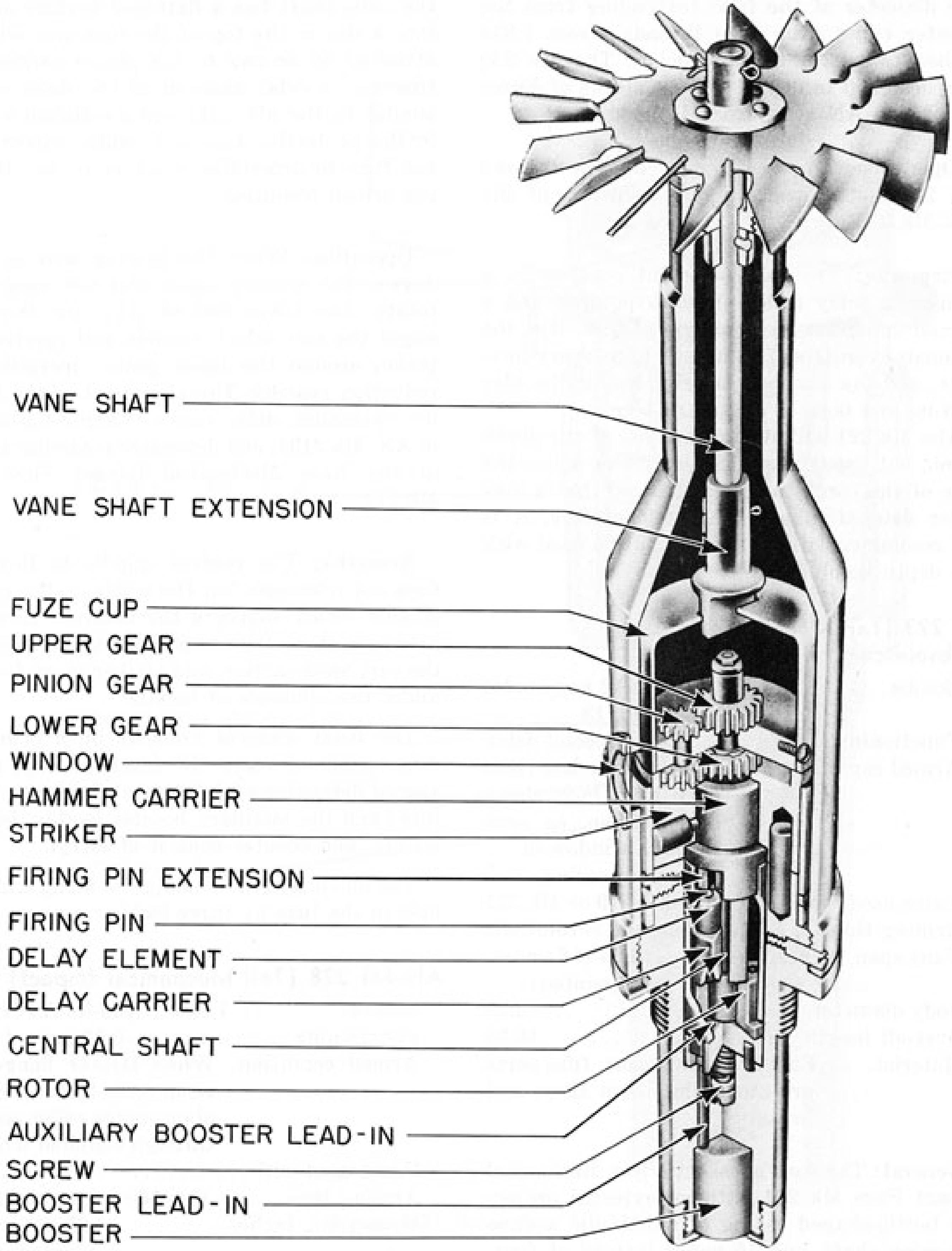


Figure 363. Tail Fuze Mk 223

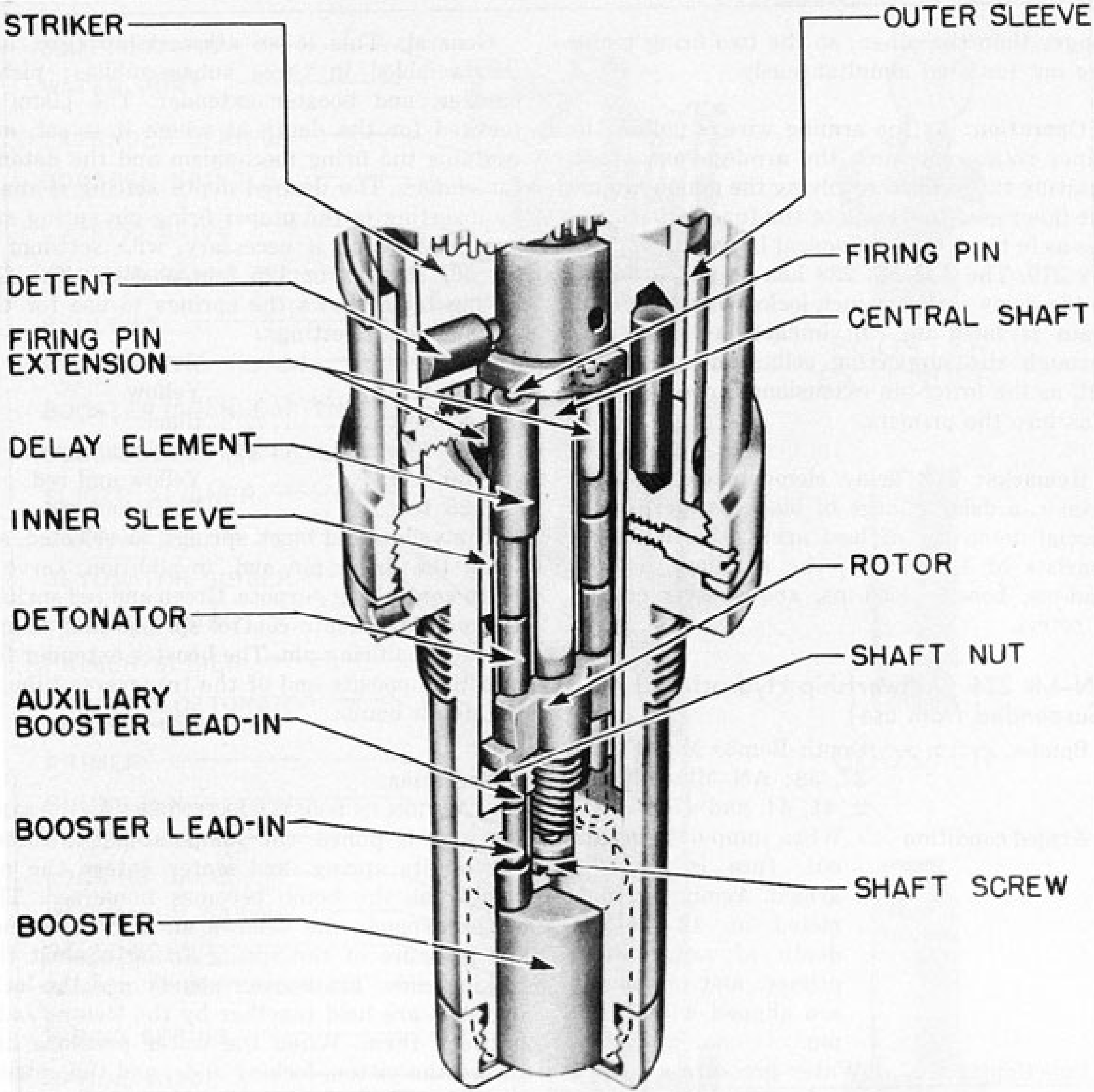


Figure 364. Tail Fuze AN–Mk 228

Material.........Steel, aluminum alloy, and brass; the brass parts are tin plated and some steel parts are cadmium plated.

General: This fuze is similar in design and operation to the Tail Mechanical Impact Fuze Mk 223, and is almost identical in external appearance. It is distinguished from the Mk 223 in that it has red vanes. The AN–Mk 228 has the following distinctive internal features: It has two separate explosive trains and a delay of 0.08 second; two firing-pin extensions are fitted on the lower end of the hammer carrier. Two delay elements and two delay firing pins are housed in the delay carrier. The detonator carrier has two detonators, and the shaft extension nuts contain two auxiliary booster lead-ins which are aligned with two booster lead-ins in the fuze body. One firing pin is slightly

longer than the other; so the two firing trains are not initiated simultaneously.

Operation: As the arming wire is pulled, the vanes rotate and turn the arming-vane shaft, rotating the cap and revolving the pinion around the inner gears. Arming of the fuze then continues as in the Nose Mechanical Impact Fuze AN–Mk 219. The AN–Mk 228 has an added detent in the delay carrier which locks when the firing train is lined up. On impact, a shear wire through the supporting collar and spindle is cut, as the firing-pin extensions force the firing pins into the primers.

Remarks: The delay elements consist of a primer, a delay charge of black powder, and a special detonator of lead azide; the detonator consists of lead azide; the auxiliary booster lead-ins, booster lead-ins, and booster consist of tetryl.

AN–Mk 224 (Athwartship Hydrostatic) (Suspended from use)

Bombs..........Depth Bombs Mks 17, 29, 37, 38; AN–Mks 17 Mod 2, 41, 44, and 47

Armed condition....When jump-out pins are out, fuze is partially armed. Arming is completed at 12 – 15-foot depth of water when primer and detonator are aligned with firing pin.

Functioning.......Water pressure at depth set for 25, 50, 75, 100, or 125 feet of water

Fuzes used with....AN–M103, AN–Mk 219, or Mk 221 in nose, and Mk 229 in tail in 650-lb. depth bombs

Over-all length, inches....Pistol assembly—6.9; booster extender assemblies —9.9

Body diameter, inches..................3.6

Material...............Bronze, brass, steel, and aluminum

General: This is an athwartship fuze, and is assembled in three subassemblies: pistol, booster, and booster extender. The pistol is marked for the depth at which it is set, and contains the firing mechanism and the detonator sliders. The desired depth setting is made by inserting in the proper firing-pin spring and auxiliary spring if necessary, with settings of 25, 50, 75, 100, or 125 feet possible. The following table shows the springs to use for the various depth settings:

DEPTH	SPRING COLOR
25 feet	Yellow
50 feet	Black
75 feet	Black and green
100 feet	Yellow and red
125 feet	Black and red

The yellow and black springs, as selected, actuate the firing pin and, in addition, serve a depth-controlling purpose. Green and red springs are auxiliary depth-control springs and do not actuate the firing pin. The booster extender fits into the opposite end of the transverse tube in the depth bomb.

Operation

ACTION IN BOOSTER EXTENDER: As the arming wire is pulled, the jump-out pin is forced out by its spring, and water enters the assembly as the bomb becomes immersed. The water expands the bellows until it overcomes the pressure of the spring acting against the locking slide. The booster spindle and the locking slide are held together by the locking balls between them. When the water pressure has forced the piston, locking slide, and the spindle inward sufficiently for the locking balls to slip into the enlarged groove in the fuze body, the entire booster extension is free to move the remaining inch toward the pistol. The hollow-cone shaped slider aligner, bearing inward against the L-shaped primer and detonator sliders, forces them inboard against their springs, thus lining up the explosive train.

ACTION IN PISTOL: As the water pressure increases and overcomes the tension of the firing and auxiliary depth springs in the piston, the bellows extend and the base of the hydrostatic piston moves down over the firing pin

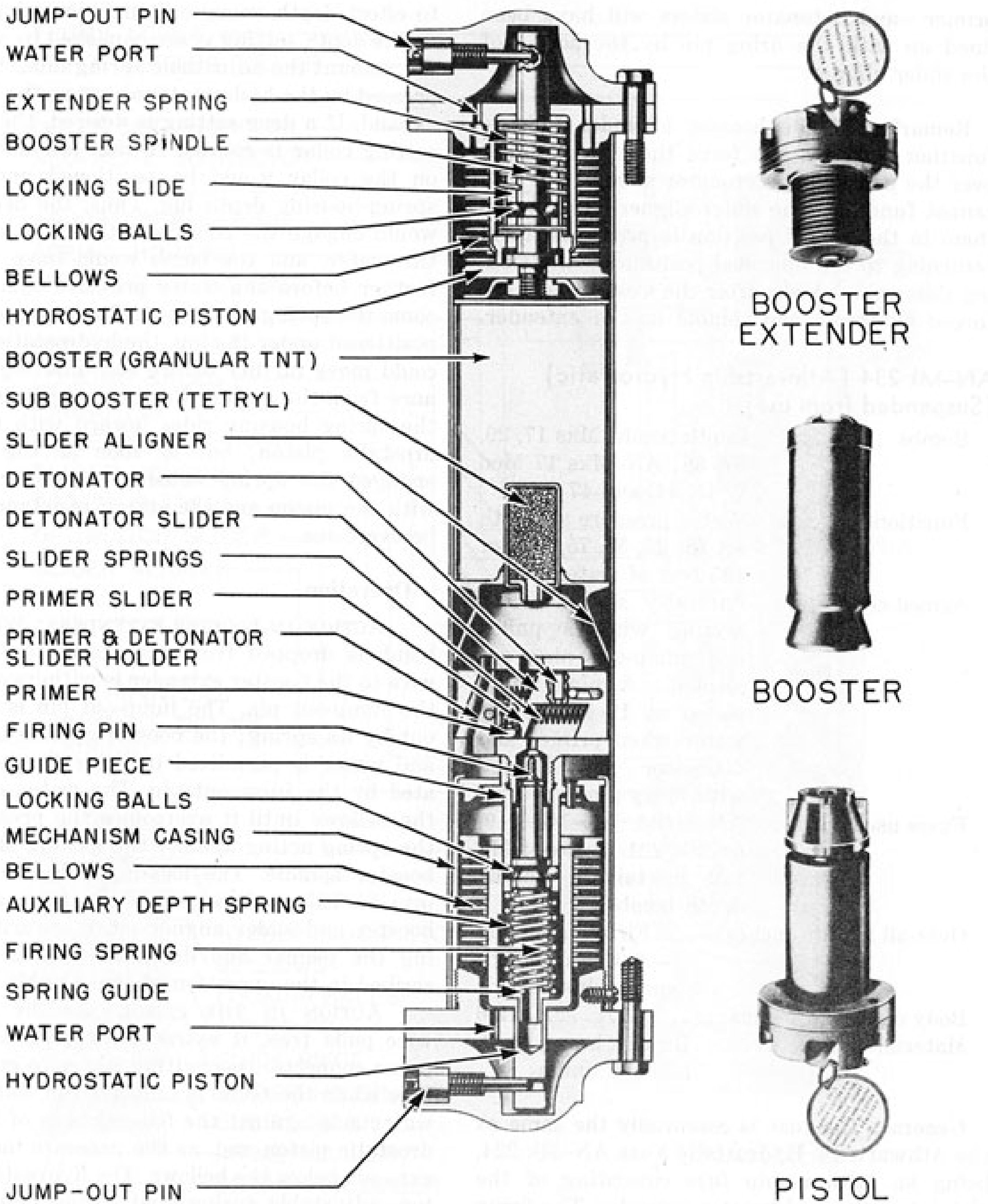


Figure 365. Athwartship Hydrostatic Fuze AN-Mk 224

guide piece. This action compresses the firing and auxiliary depth springs; and, when the enlarged part of the hydrostatic piston comes opposite the locking balls, they are forced out by the spring pressure, freeing the firing pin to be forced against the primer. The L-shaped

primer and detonator sliders will have been lined up with the firing pin by the action of the slider aligner.

Remarks: If the booster extender fails to function properly and force the slider aligner over the primer and detonator sliders, the fuze cannot function. The slider aligner which holds them in the armed position is prevented from returning to the unarmed position by the locking slide, which locks after the locking balls are forced out from the spindle in the extender.

AN–Mk 234 (Athwartship Hydrostatic) (Suspended from use)

Bombs	Depth bombs Mks 17, 29, 37, 38; AN–Mks 17 Mod 2, 41, 44, and 47
Functioning	Water pressure at depth set for 25, 50, 75, 100, or 125 feet of water
Armed condition	Partially armed when arming wire is pulled and jump-out pins are ejected. Arming completed at 12–15 feet of water when primer and detonator are aligned with firing pin.
Fuzes used with	AN–M103, AN–Mk 219, or Mk 221 in nose; Mk 229 in tail in 650-lb. depth bombs.
Over-all length, inches	Firing assembly —6.9; Extender assembly—9.9
Body diameter, inches	3.6
Material	Bronze, brass, steel, and aluminum

General: The fuze is essentially the same as the Athwartship Hydrostatic Fuze AN–Mk 224, being an athwartship fuze consisting of the pistol, booster, and booster extender. The firing assembly and booster extender are inserted in the athwartship tube of the depth bombs from opposite sides. The AN–Mk 234 differs from the AN–Mk 224 in that it has an external setting device and does not require disassembly to effect depth variations in functioning.

The depth setting is accomplished by varying the amount the adjustable spring must be compressed by the hydrostatic piston as the bellows expand. If a deep setting is desired, the depth-setting collar is rotated so that a shallow step on the collar would be positioned under the spring-housing depth lug. Thus, the depth lug would engage the collar shortly after entering the water, and the bomb would have to sink farther before the water pressure could overcome the spring resistance. If a deep step were positioned under the lug, the hydrostatic piston could move farther before encountering resistance from the spring. Until the lug is engaged, the spring housing rides inward with the hydrostatic piston; but as soon as the lug is engaged the spring housing no longer moves with the piston and the spring resistance must be overcome.

Operation

ACTION IN BOOSTER EXTENDERS: When the bomb is dropped from the plane, the arming wire to the booster extender is withdrawn from the jump-out pin. The jump-out pin is thrown out by its spring; the booster spindle is freed, and water is permitted to enter the hole created by the jump-out pin. The water expands the bellows until it overcomes the pressure of the spring acting against the locking slide and booster spindle. The locking balls are forced into an enlarged groove in the fuze, and the booster and slider aligner move inward, aligning the primer and detonator sliders, as described in the operation of the AN–Mk 224.

ACTION IN THE PISTOL: As the arming wire pulls free, it extracts the plug and neoprene connector, permitting water to enter the fuze when the bomb is immersed in water. The water acts against the flanged base of the hydrostatic piston and, as the pressure increases, expands below the bellows. The hydrostatic piston, adjustable spring, and spring housing all move inward until the depth lug engages the step on the depth-setting collar which has been positioned opposite it. At this point, the spring housing no longer moves inward. The hydrostatic piston continues to move inward under

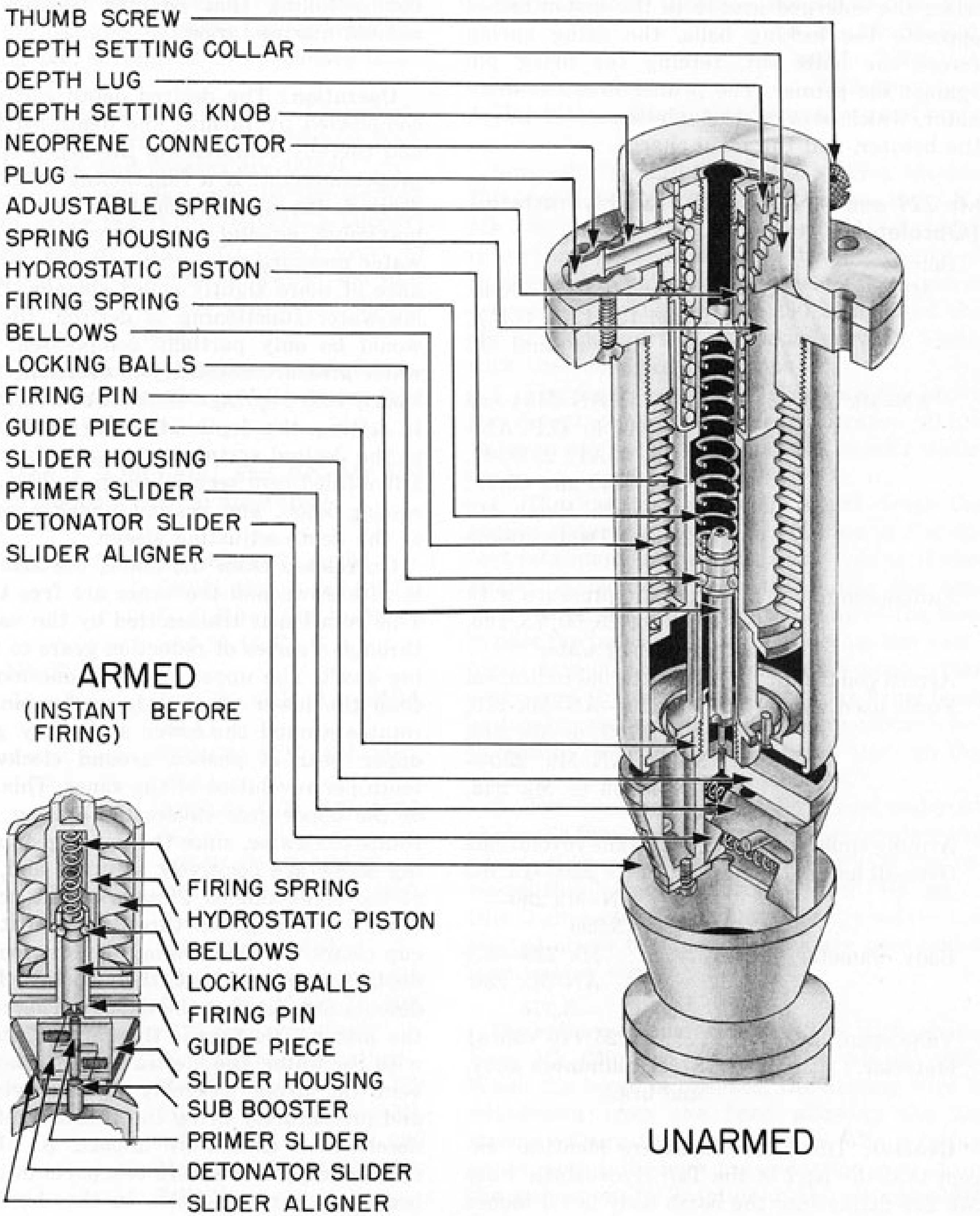


Figure 366. Athwartship Hydrostatic Fuze AN–Mk 234

pressure of the water, but its movement is restricted by the resistance of the adjustable spring. Meanwhile, the movement of the hydrostatic piston compresses the firing spring; and,

when the enlarged groove in the piston comes opposite the locking balls, the firing spring forces the balls out, forcing the firing pin against the primer. The primer fires the detonator, which sets off the sub-booster of tetryl, the booster, and the main charge.

Mk 229 and AN–Mk 230 (Tail Hydrostatic) (Obsolete)

Bombs
- Mk 229 .... 650-lb. depth bombs, 500-lb. Mks 9 and 12 (L.C., G.P.); 1,000-lb. Mks 9 and 13 (L.C., G.P.)
- AN–Mk 230 ..... 500-lb. G.P. AN–M64 and 64A1; 1,000-lb. G.P. AN–M65 and 65A1; 2,000-lb. G.P. AN–M66 and 66A1; 325-lb. Depth Bomb Mk 53, 350-lb. Depth Bomb Mk 54

Functioning ...... Hydrostatic pressure with settings for 25, 50, 75, 100, or 125 feet of water
Armed condition ...... No external indication
Fuzes used with ...... Mk 229—AN–Mk 219, AN–M103, or Mk 243, Nose; AN–Mk 230—AN–M103 or Mk 243, Nose
Arming time .... 110 vane revolutions
Over-all length, inches ...... Mk 229—16.365 AN–Mk 230—15.395
Body diameter, inches .... Mk 229—3.4 AN–Mk 230—3.375
Vane span, inches .... 5.25 (16 vanes)
Material .... Steel, aluminum alloy, and brass

General: These two fuzes are identical, except that the part of the Tail Hydrostatic Fuze Mk 229 fitting into the bomb body is 1.3 inches longer than the corresponding part of the AN–Mk 230; hence, the AN–Mk 230 cannot be used in bombs that take the Fuze Mk 229. The AN–Mk 230 fits into the Adapter Booster M115 or M115A1, and can be used in the general-purpose bombs taking that adapter booster for use against marine targets.

Operation: The desired depth setting is accomplished by turning the depth-setting knob and thereby compressing the depth spring the proper amount. If a functioning at 125 feet is desired, the spring would be compressed the maximum amount, consequently causing the water pressure to overcome the greater resistance of more tightly coiled springs. If a shallow-water functioning is desired, the springs would be only partially compressed, and the water pressure necessary to overcome the more loosely coiled springs would be considerably less. In setting, the depth-adjusting sleeve is raised to the desired spring compression by means of a five-sided cam secured to the external depth-setting knob, and resting under a projection of the depth-adjusting sleeve.

On release from the plane, the arming wire is withdrawn and the vanes are free to rotate. This rotation is transmitted by the vane shaft through a series of reduction gears to the arming shaft. The upper gear has one more tooth than the lower gear, and, as the pinion gear rotates around the lower stationary gear, the upper gear is pushed around clockwise one tooth per revolution of the vanes. This rotation of the upper gear causes the arming screw to rotate clockwise, since the upper gear and arming screw are positively secured; and, because of the right-handed threads on the screw, the detent retaining cup threads up on it. As the cup clears the two arming detents locking the depth-spring stem nut, their springs force the detents out, freeing the depth spring stem and the piston. The fuze is then armed. On impact with the water, the inertia counterbalances prevent the firing assembly from moving down and prematurely firing the fuze because of the deceleration caused by impact. As the bomb submerges, water enters two ports in the outer body and through holes in the depth-setting mechanism housing. Hydrostatic pressure, acting on the sylphon bellows, forces the hydrostatic piston downward, compressing the firing spring, until the retaining balls fall out into the widened portion of the piston. The firing

plunger is then forced downward by the pressure of the compressed firing spring onto the fixed firing pin, setting off the explosive train.

Remarks: The detonator consists of fulminate of mercury and tetryl pellets. The booster lead-in, relay pellets, and booster are tetryl.

The O-ring gasket has replaced the Garlock gasket. In using the O-ring gasket, a support ring (steel washer 0.120 inch thick) must be used to assure metal contact between the fuze and fuze-seat liner, thereby preventing distortion of the fuze on impact.

Do not disassemble this fuze without reinserting the safety pin through the lower fuze body and firing plunger.

Mk 229 Mod 3 (Obsolete) and AN–Mk 230 Mods 4, 5 and 6 (Tail Hydrostatic)

Bombs

Mk 229 Mod 3....650-lb. depth bombs 500-lb. Mks 9 and 12 (L. C., G.P.); 1,000-lb. Mks 9 and 13 (L.C., G.P.)

AN-Mk 230 Mods 4, 5, and 6.....500-lb. G.P. AN–M64, 64A1
1,000-lb. G.P. AN–M65, 65A1
2,000-lb. G.P. AN–M66, 66A1
325-lb. Depth MK 53 and AN–Mk 53 Mod 1; 350-lb. Depth Mk 54 and AN–Mk 54 Mod 1

Functioning......Hydrostatic pressure with settings for 25, 50, 75, 100, or 125 feet of water

Armed condition....No external indication

Fuzes used with....Mk 229 Mod 3—AN–Mk 219, AN–M103 or Mk 243, Nose; AN–Mk 230 Mod 4—AN–M103 or Mk 243, Nose

Arming time..........110 vane revolutions

Over-all length, inches...Mk 229 Mod 3—16.365; AN–Mk 230 Mods 4, 5, and 6—15.395

Body diameter, inches...Mk 229 Mod 3—3.4; AN–Mk 230 Mods 4, 5, and 6—3.375

Vane span, inches...........5.25 (16 vanes)

Material....Steel, aluminum alloy, and brass

General: The Tail Hydrostatic Fuzes AN–Mk 230 Mod 4 and Mk 229 Mod 3 replace the AN–Mk 230 and Mk 229. The latest Mods incorporate changes which eliminate the possibility of the fuzes arming accidentally when the bomb is dropped safe. The AN–Mk 230 Mod 4 and the Mk 229 Mod 3 are the same as previous Mods, with the following exceptions:

1. The fuze is sealed by a sealing cup above the detent carrier to prevent entrance of the water at any point other than the regular water ports.

2. The arming mechanism which frees the arming detents operates by rotation of the detent retaining cup rather than by raising it vertically. A metal strap is fitted over the cup. These additions (a) prevent arming of the fuze in case the tail cone or arming-mechanism housing is torn off the fuze accidentally upon water entry, and (b) prevent the fuze from firing from hydro-dynamic pressures which are encountered in erratic movement of the bomb through the water or on re-entry after ricochet.

3. The fuzes now have a slight oval undercut above the fuze-pocket threads to accomodate the new O-ring gasket (live rubber) which has replaced the flat gasket formerly used. By use of this O-ring gasket, the holes for the safety rod located above the fuze threads are now sealed from water entry.

Operation: In operation, the Tail Hydrostatic Fuze Mk 230 Mod 4 is like the AN–Mk 230. When the bomb is released, the arming wire is withdrawn from the fuze, allowing the air stream to turn the arming vanes. The rotating vanes, acting through the reduction gear, turn the arming shaft. Rotation of the arming shaft first causes the arming nut assembly to rise (since it cannot turn because of the two pins which project into the detent carrier). When the two pins of the arming nut are fully clear of the detent carrier, the arming nut "washer"

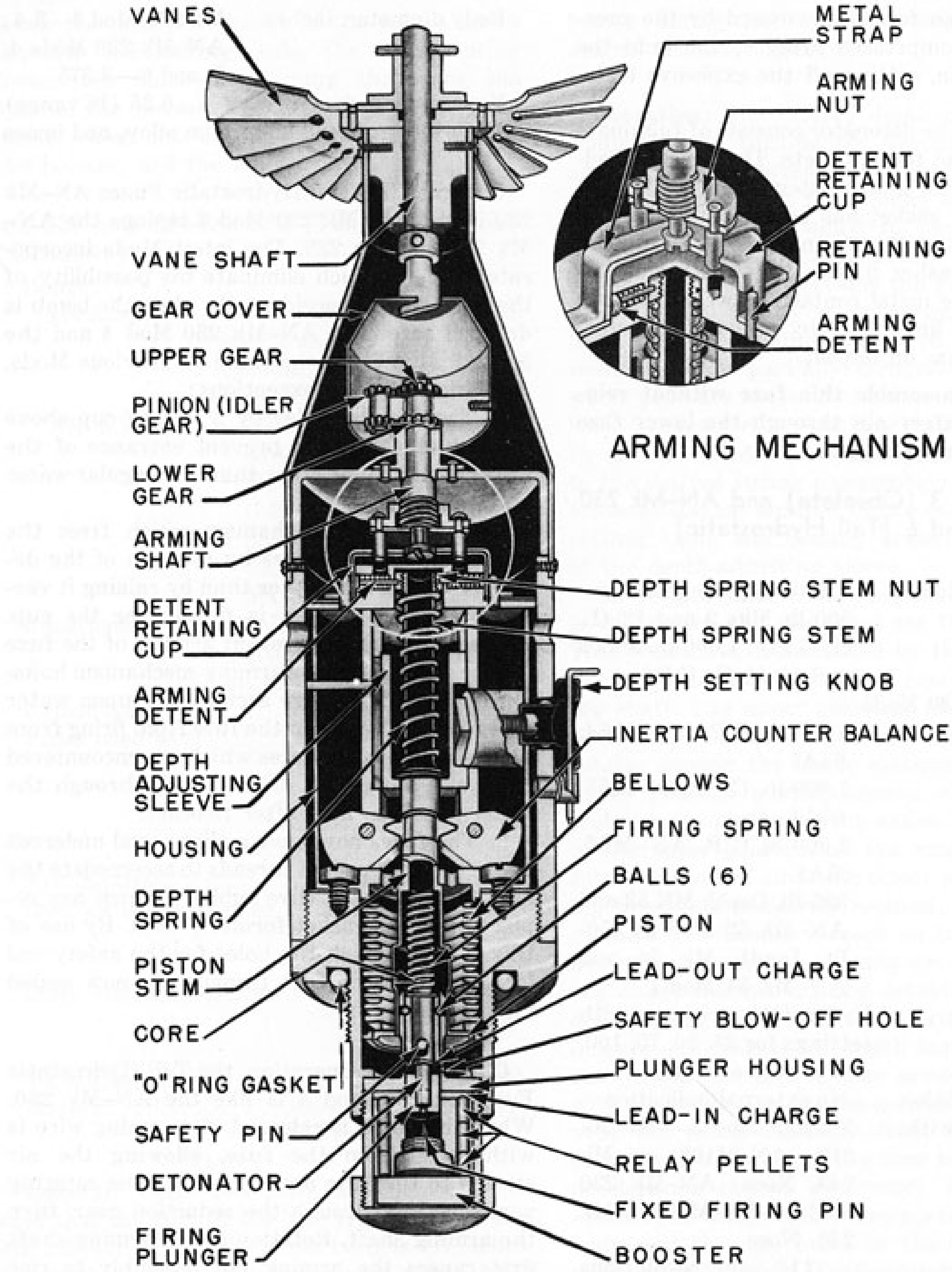


Figure 367. Tail Hydrostatic Fuze AN–Mk 230 Mod 4

jams under the arming shaft, preventing further rising. The arming shaft then turns the

arming nut assembly and, by means of the two pins, rotates the detent retaining cup approximately 85°, until the two cutaway portions align themselves opposite the detents. The detents are then ejected, freeing the depth-spring stem nut and thereby arming the fuze. To limit the amount of water entering the sylphon bellows, the detents are prevented from jumping completely out of the detent carrier by the detent retaining pins which are fitted into the flange of the detent carrier. The inertia counterbalances prevent the fuze from functioning on impact with the surface of the water. After the bomb has submerged, water enters the fuze through two water ports in the body sleeve, and the fuze fires at the predetermined depth setting. The use of the sealing cup above the detent carrier prevents water entry through the open end of the fuze in case the tail cone is broken off on impact.

Remarks: Do not disassemble this fuze without reinserting the safety pin through the lower fuze body and firing plunger.

Earlier productions of these fuzes did not incorporate an undercut. In using the O-ring gasket with these fuzes, a support ring (steel washer, 0.120 inch thick) must be used to assure metal contact between the fuze and the fuze-seat liner, thereby preventing distortion of the fuze on impact.

The Tail Hydrostatic Fuze AN–Mk 230 Mod 5 is the same as the AN–Mk 230 Mod 4, except that the firing pin is welded to the booster cap as in the Mk 231, and the depth setting is emphasized for 25 feet and relaxed for 50 feet.

The AN–Mk 230 Mod 6 is the same as the AN–Mk 230 Mod 4, except that the depth setting is emphasized for 25 feet and relaxed for 50 feet.

Mk 231 Mod 0 and Mk 240 Mod 0 (Tail Hydrostatic)

Bombs

Mk 231 Mod 0....350-lb. Depth AN–Mk 54 Mod 1
500-lb. G.P. AN–M64
500-lb. G.P. AN–M64A1

Mk 240 Mod 0....1,000-lb. G.P. AN–M65
1,000-lb. G.P. AN–M65A1
2,000-lb. G.P. AN–M66
2,000-lb. G.P. AN–M66A1
2,000-lb. G.P. AN–M66A2

Functioning..Hydrostatic pressure at 25 feet
Armed condition.....No external indications
Arming time........40-45 vane revolutions; 300-400 feet air travel; 35-100 feet vertical fall
Over-all length, inches...Mk 231 Mod 0—12.5
Mk 240 Mod 0—16.5
Body diameter, inches................3.375
Material....Steel, aluminum alloy, and brass

General: The Tail Hydrostatic Fuze Mk 231 Mod 0 and Mk 240 Mod 0 are tail hydrostatic fuzes in the general design scheme of the Mk 229 and Mk 230. They are considerably simpler in construction, however, and easier to manufacture. The Mk 240 Mod 0 is four inches longer than the Mk 231 Mod 0, to assure proper arming in larger bombs, but is otherwise identical to the Mk 231 Mod 0. A single depth setting is provided, and the fuzes are expected to function in a depth range of 25 to 30 feet.

To provide positive action against fuze function on reverse impacts (particularly ricochets), these fuzes have an inertia ring which adds its weight to that of the piston assembly to counteract the force of the two counterbalances exerting a contrary pressure in such impacts. On normal impacts, the inertia ring merely rests on the firing-pin housing.

Operation: Upon release of the bomb from the plane, the arming wire is withdrawn, permitting rotation of the vane and the vane shaft. Rotating with the vane and threading out of the arming-stem guide is the arming stem; after 40 to 50 vane revolutions the stem has risen sufficiently to allow the two arming balls to fall inward, freeing the hydrostatic piston and arming the fuze.

At normal impact with water, the inertia counterbalances prevent the fuze from firing; and, on reverse impact, the inertia ring operates as previously mentioned. After submersion, water flows around the baffle ring and into the

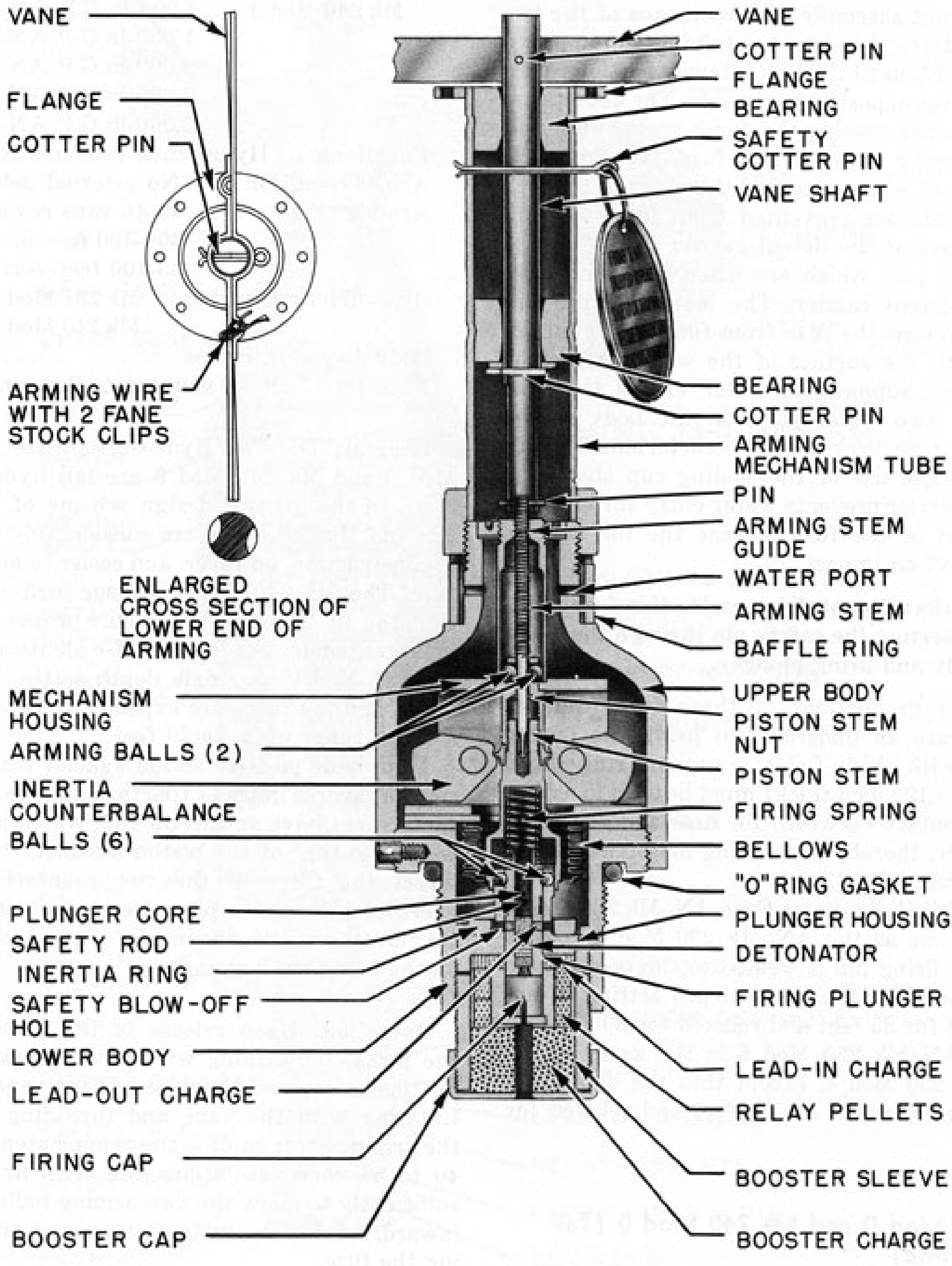


Figure 368. Tail Hydrostatic Fuze Mk 231 Mod 0

fuze through the two ports. The baffle ring prevents the fuze from firing when subjected to sudden surges of water such as might occur on reverse impact. Hydrostatic pressure now extends the bellows, thus forcing the hydrostatic piston downward and compressing the firing

spring. After the piston has moved 9/32 inch, the six retaining balls locking the firing plunger to the plunger housing jump into the annular recess in the piston. The compressed firing spring thrusts the plunger against the firing point, initiating the explosive train.

Remarks: The lower end of the arming stem is grooved for about 0.2 inch of its length. The purpose of this feature is to arrest arming of the fuze, should the bomb be accidentally released in water without the arming wire, as in crash landings. In this event, water might rotate the vane, initiating arming action. Arming would be stopped, however, once the grooved section faced the balls, since hydrostatic pressure on the piston assembly would force the balls into the grooves, jamming the arming stem in place and preventing further rotation of the vane.

The vane shaft is connected to the arming stem by a slip joint, to remove the danger of arming the fuze by a blow damaging or carrying away part of the arming mechanism. In this connection, it will be noted that the arming-mechanism tube has a circumferential groove near its base which is provided to cause shearing at that point, should the force of impact break off part of the arming mechanism.

When the Tail Hydrostatic Fuze Mk 240 Mod 0 is used in the 2,000-pound G.P. Bomb AN–M66, it is to be equipped with a special 26.5° pitch vane, to assure proper arming; the standard 20° pitch vane of the Mk 231 Mod 0 will be used when the Fuze Mk 240 Mod 0 is installed in the 1,000-pound G.P. bomb AN–M65. The special-pitch vane will be painted. (No color has been specified at the time of writing.)

Production of the Tail Hydrostatic Fuze Mk 231 Mod 0 has been stopped because of adequate supplies of the Tail Hydrostatic Fuzes AN–Mk 230 Mods 4, 5, and 6. The Mk 240 Mod 0 will not be produced at all.

Mk 232 Mod 1 (Nose Impact or Electrical Firing)

Bombs	All G.P. and depth bombs, and old-type demolition and L.C. bombs
Functioning	Impact instantaneous or electrical impulse
Armed condition	When vanes are 3/8 inch away from striker housing
Fuzes used with	Usually none
Arming time	8 vane revolutions
Over-all length, inches	7
Body diameter, inches	2.5
Vane span, inches	5.125 (16 vanes)
Material	Steel and brass

General: The Nose Impact or Electrical Firing Fuze Mk 232 Mod 1 is a bomb nose fuze of the arming-vane type, requiring little air travel to arm. It may be initiated by an electrical impulse or impact on a hard surface, detonating instantaneously. The fuze has an electric semi-cap which, when fired by an impulse, blows through a hole leading to the detonator and sets it off. For electrical firing as well as impact, the fuze must first be armed, allowing the detonator slider to move over into a position where the detonator can be initiated by either the firing pin or the explosion of the semi-cap.

Operation

AS AN IMPACT FUZE: A cotter pin, which is wired in place with a small fuze wire, prevents the arming vanes from rotating. The arming wire is attached to this cotter pin, and withdrawal of the arming wire breaks the light fuze wire. The vanes are then rotated by action of the wind stream, and this rotation is transmitted to the striker, which advances on the threads in the striker housing. It advances until stopped by the striker stop coming up against the bottom of the striker housing. As the striker advances on its threads, it withdraws the firing pin from the slider, which is then forced over by its springs, lining the detonator up with the firing pin and booster lead-in. A detent locks the detonator slider in the armed position. Upon impact, the brass collar threads are sheared by the firing-pin block, and the firing pin is forced into the detonator.

ELECTRICAL FIRING: Detonation is initiated by means of the squib being directly fired by an electric current through the igniter bridge.

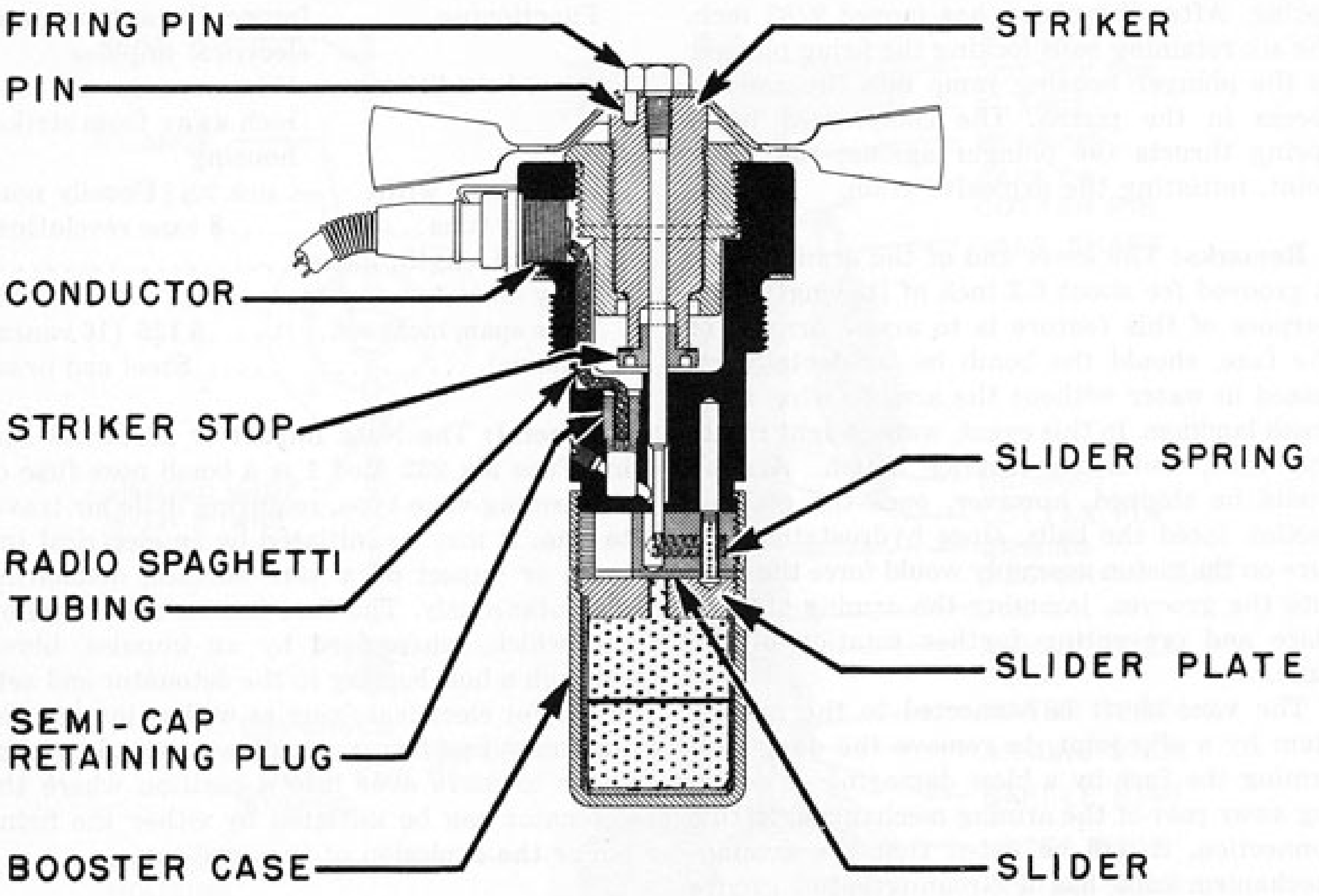


Figure 369. Nose Impact or Electrical Firing Fuze Mk 232 Mod 1

Remarks: The fuze will not function on impact with water, but must strike a hard surface in order to strip the striker-housing threads.

No attempt should be made to unarm this fuze by rotating the vanes backward.

Mk 233 (Nose Electrical)

Bombs	100-lb. G.P. Mk 4 Mod 4
Functioning	Electrical impulse
Armed condition	When cable is pulled free from rotor cap, and cap is in a locked condition
Fuzes used with	Mk 232 Mod 1
Arming time	Rotation of the rotor cap 180 degrees, when pulled by the cable attached to it
Over-all length, inches	4.51
Body diameter, inches	2.375
Material	Steel

General: The fuze will function instantly upon explosion of the electric semi-cap. It is mechanically armed by means of a motor in the plane. The body is that of a Nose Mechanical Impact Fuze AN–Mk 219, in which the vanes, cap, and rotors have been removed, and a hole has been drilled in the shoulder for the accommodation of electric wiring. A rotor block has been inserted in the rotor cavity in the fuze body. The rotor block contains an electric semi-cap with lead-in wires and a detonator. These units are assembled, unarmed, 180 degrees from the booster lead-in in the fuze body.

Operation: In the unarmed position the detonator in the rotor is offset 180 degrees from the booster lead-in. To arm the fuze, the rotor is rotated 180 degrees, at which point the detonator and booster lead-in are aligned. This is accomplished by means of a motor in the airplane,

exerting a pull on one end of the arming cable. This pull rotates the pulley to which the other end of the cable is secured, and thereby rotates the rotor to the armed position. There it is locked by the lock detent. Continuing force of the motor's pull on the arming cable shears the 0.035-inch copper shear wire which secures the cable to the pulley.

The protective shipping cap covering the connector plug is removed when the fuze is assembled to the bomb, and connection is made with the source of electrical current in the airplane. Closing the electrical circuit after the fuze is armed successively initiates the semi-cap, detonator, booster charges, and explosive charge in the bomb.

Remarks: The detonator consists of lead azide, and the booster lead-in and booster consist of tetryl.

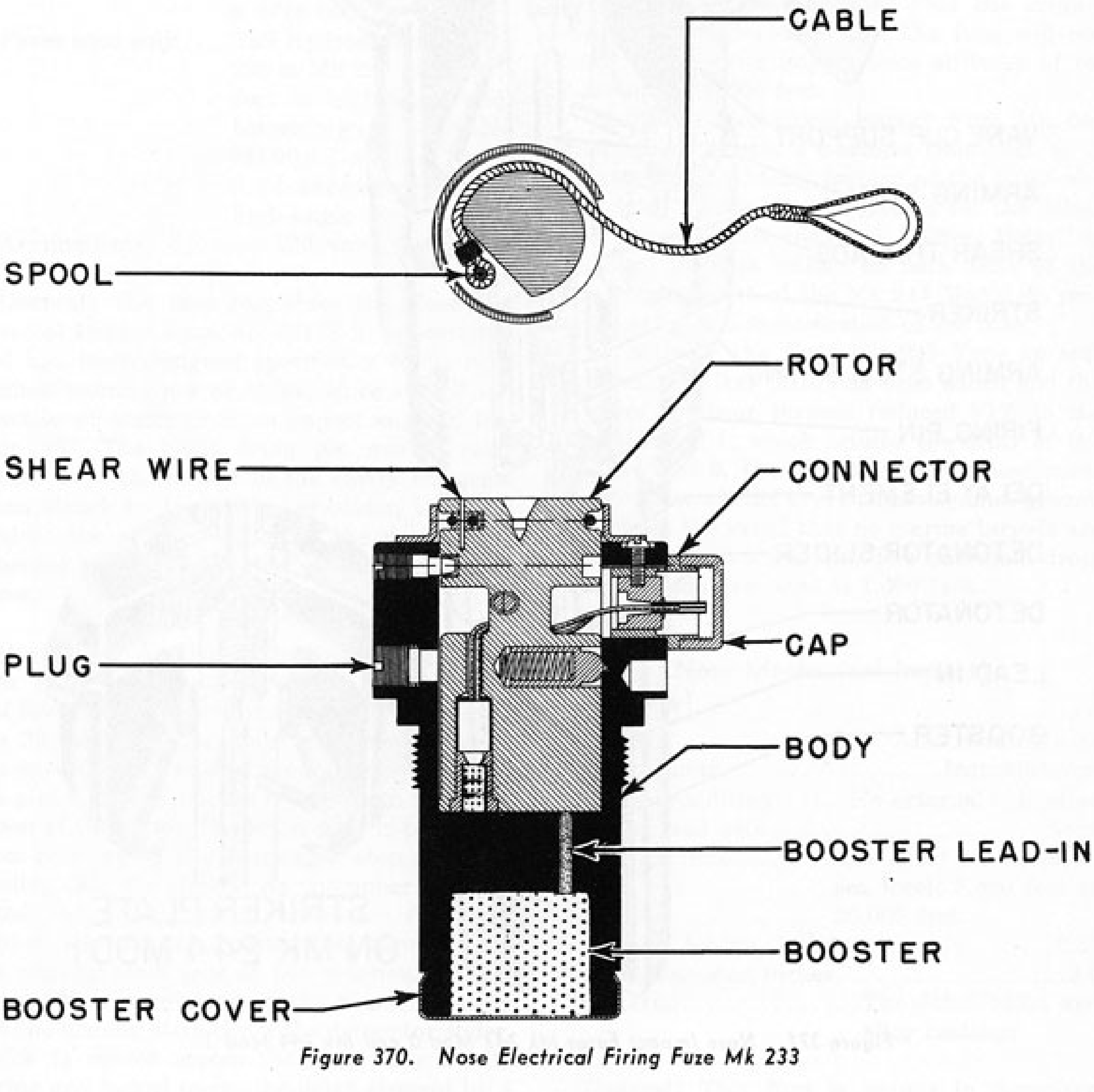


Figure 370. Nose Electrical Firing Fuze Mk 233

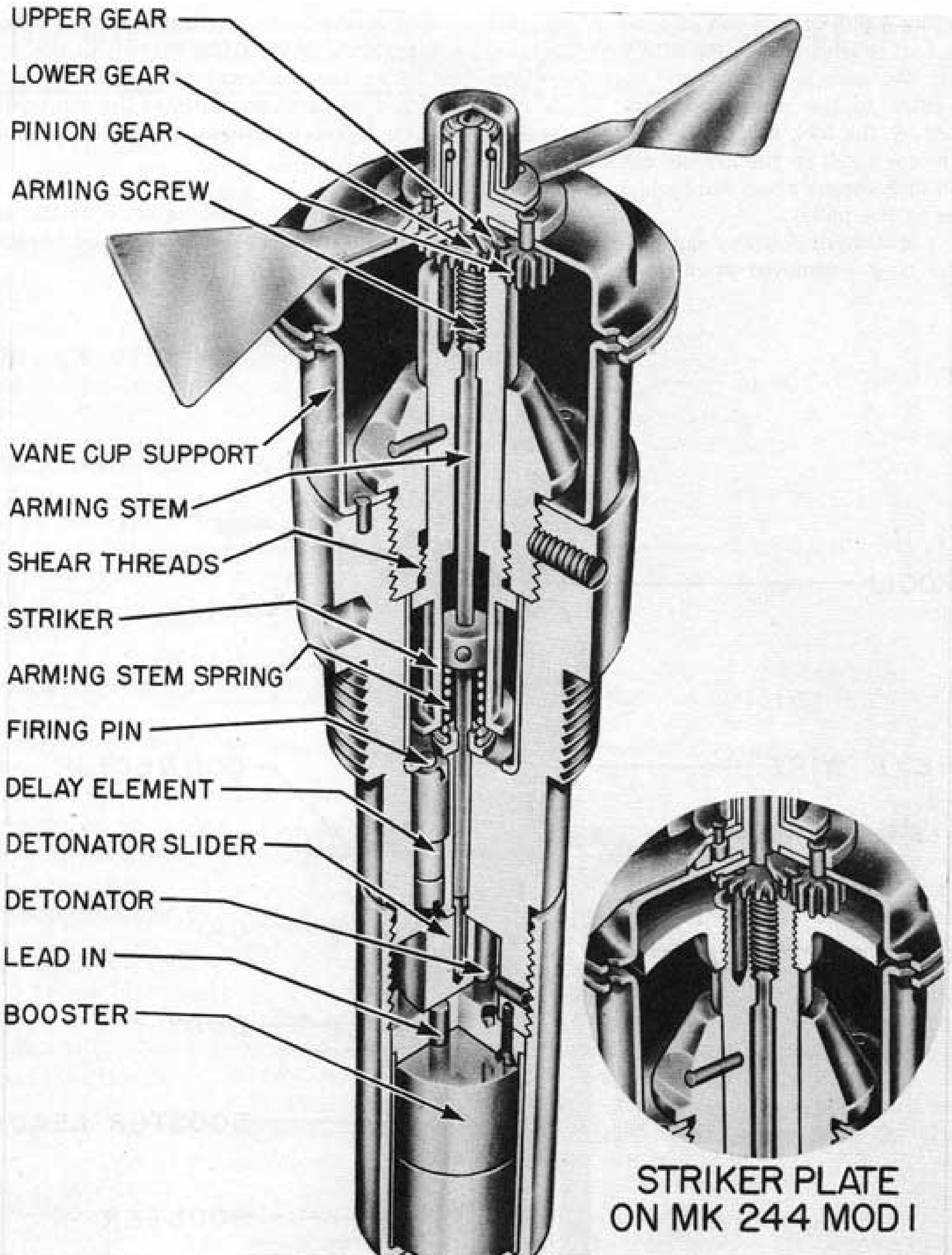


Figure 371. Nose Impact Fuzes Mk 243 Mod 0 and Mk 244 Mod 1

Mk 243 Mod 0 and Mk 244 Mods 0 and 1 (Nose Mechanical Impact)

Bombs.....500-lb. G.P. AN-M64 and 64A1
500-lb. G.P. Mk 12 Mod 2
1,000-lb. G.P. AN-M65 and 65A1
1,000-lb. G.P. Mk 13 Mod 2
2,000-lb. G.P. AN-M66 and 66A1

Functioning, Mk 243 Mod 0....Delay of 0.025 second

Armed condition...When space between vane cup and vane-cup support is 5/16 inch

Fuzes used with....Tail Hydrostatic AN-Mk 230 or Mk 229 (set for 25 feet in high-speed glide bombing); or AN-M100A2 series (with 0.24-second delay for high-angle drops)

Arming time..........130 vane revolutions

General: The fuze resembles the Nose Mechanical Impact Fuze AN-M103 in appearance, and has been designed specifically to be used against submarines or ships, since it will not function on water or at an impact angle of less than 45°. The blunt firing pin merely rests loosely over the primer in the cavity cup, and, when struck by the striker shoulder, is driven against the primer, initiating the delay. It is intended as a replacement for the hydrostatic fuzes.

Operation: As the vanes rotate, the pinion gear revolves around the upper movable gear and lower stationary gear. Since the upper gear has 23 teeth and the lower gear has 22 teeth, the upper gear is pushed around clockwise with the pinion by the amount of one tooth per revolution of the vanes. The lower gear is prevented from rotating by the lower-gear stop arm protruding into the striker. As the upper gear rotates, the arming screw unthreads from the striker, allowing the arming stem spring to lift the arming stem free of the detonator slider. After 130 vane revolutions, the vanes fall away and the arming stem clears the detonator slider, which is moved across the fuze body by its spring and locked under the delay element by a detent and the slider locking pin. On impact with a hard surface, the striker body is forced inward, shearing both the locating pin and the shear threads and forcing the shoulder of the striker against the blunt firing pin. The firing pin sets off the primer delay of 0.025 second, the detonator, the booster lead-in, and the booster in succession.

Remarks: When using this fuze, check the vanes by simply turning back and forth a few times in order to determine that the arming mechanism operates easily. The fuze will not function on water impact from altitudes of release up to 20,000 feet.

The Nose Mechanical Impact Fuze Mk 244 Mod 0 incorporates a 4-second (minimum of 4, maximum of 5) delay instead of the 0.025-second delay of the Mk 243. Except for the delay, the two fuzes are identical. "4-Sec. Delay" is stamped in black letters on both sides of the vane cup support of the Mk 244 Mod 0, to provide easy visual identification of the fuze.

To activate the Fuze Mk 243 Type on soft ground, a striker plate has been added and the number of shear threads reduced 50% in the Mk 244 Mod 1, which retains the delay of the Mk 244 Mod 0. The modification has been made to allow use of this type of fuze against ground targets in the event that no marine targets are encountered on a mission. The minimum dropping altitude over land is 1,000 feet.

Mk 227 (Nose Mechanical Impact) (Obsolete)

Bomb..............5-lb. A.A. Bomb Mk 34

Functioning.................Instantaneous

Armed condition......No external indication

Fuzes used with.....................None

Arming time........1,500 feet air travel at sea level; 3,000 feet at 20,000 feet

Over-all length, inches................2.35

Body diameter, inches..................2.0

Material..............Tin-plated brass and alloy castings

General: This fuze is unique in American

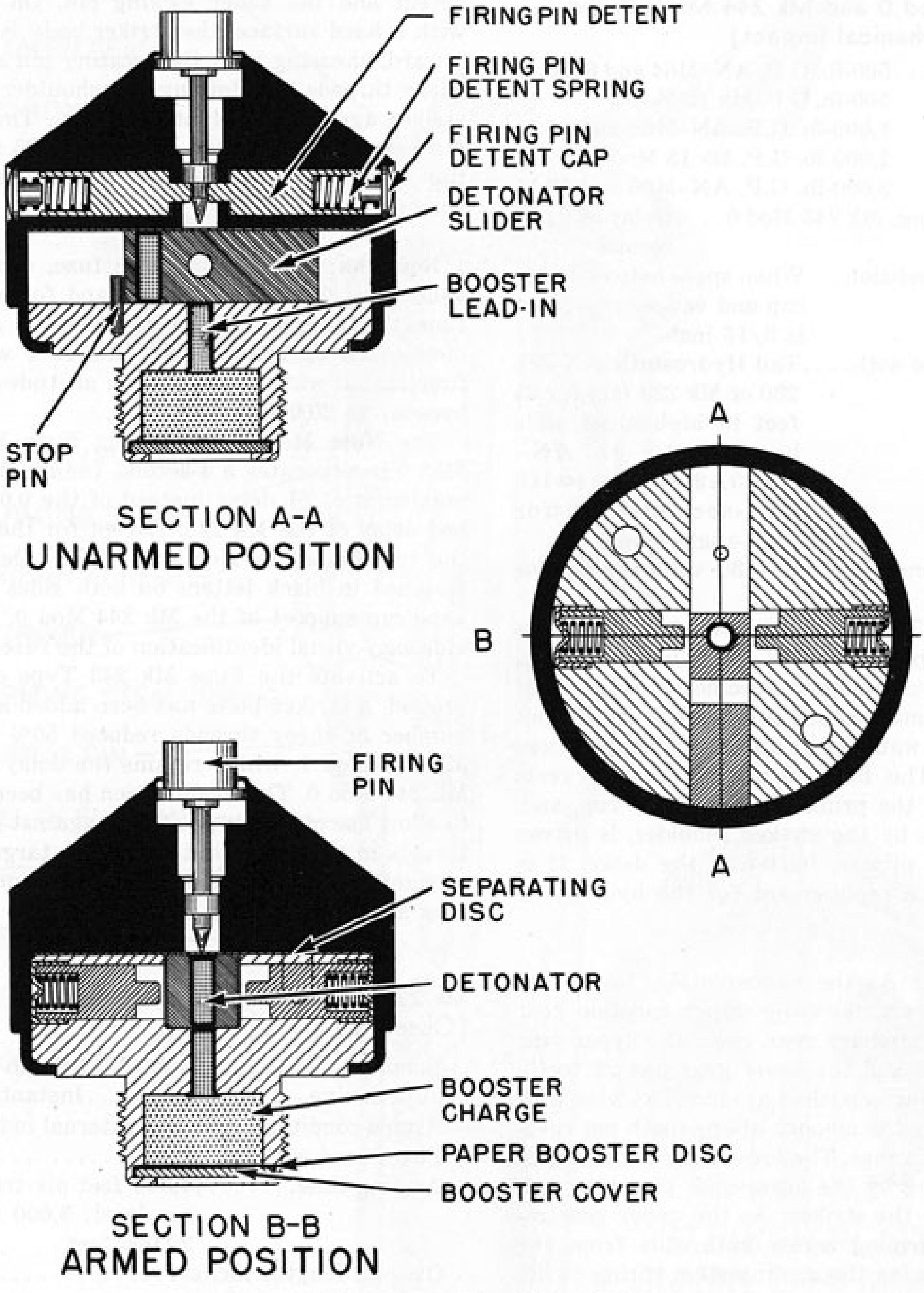


Figure 372. Nose Fuze Mk 227

aviation ordnance in using centrifugal force as its arming device. The rotational velocity required to arm the fuze is acquired by the offset tail fins on the small bomb.

Operation: Two pairs of centrifugal detents are employed—one pair supporting the striker, and the second pair positioning the slider with the primer detonator out of line with the firing pin. At a rotational velocity of 1,500 r.p.m., the detents move out of the way, compressing their springs and allowing the slider freedom of movement. The slider is mounted with its center of gravity away from the axis of rotation; so, when the detents move out of the slider, centrifugal force carries the slider into line with the firing pin. Upon impact, the firing pin is driven into the primer detonator, initiating the explosive action.

Remarks: The Bomb Mk 34 and Fuze Mk 227 were designed for air-to-air bombing, but have not proved successful in this use. It has, however, had limited use against parked aircraft and was dropped for its nuisance value on night raids during the early stages of the war in the Pacific.

Mk 237 Mod 0 and Mk 238 Mod 0 (Tail, Lead-Shear-Wire, Long-Delay, Time)

Bombs
- Mk 237 Mod 0 . . . 500-lb. G.P. AN–M64A1
- Mk 238 Mod 0 . . . 1,000-lb. G.P. AN–M65A1; 2,000-lb. G.P. AN–M66A1, A2

Functioning . . . . . Lead-shear-wire, long-delay fuze; delays of 2, 10, 20, and 30 hours

Armed condition . . . Partially armed after approximately 150 vane revolutions; fully armed after impact

Fuzes used with . . . . None

Arming time . . . . Approximately 150 vane revolutions and impact requirement

Vane span, inches 5

Body diameter, inches 2

Over-all length, inches . . . . Mk 237 Mod 0, 13.6; Mk 238, Mod 0, 17.6

Material . . . . Zinc or cadmium-plated steel

General: These fuzes differ only in the length of their arming stem. Delay arming is obtained by means of the 30-to-1 gear-reduction system, which is like that of the Tail Fuze M115 Series. Upon completion of arming, the gear-reduction assembly and the arming stem do not separate from the fuze, but cease rotation. Functioning time of these fuzes is determined by a lead shear wire (50% lead, 50% tin). The various delays are obtained by varying the diameter of the wire, i.e., increasing the diameter for longer delays. The slider carries a Detonator Mk 23, which is made up of three explosive components; namely, azide priming mixture, lead azide, and tetryl. The fuze incorporates a tetryl booster lead-in, but does not have an integral booster.

Operation: The complete arming of the fuze is effected in two stages: air travel and impact. Upon withdrawal of the arming wire, the vane assembly rotates, causing the arming stem to rotate *via* the gear-reduction system. The lower end of the arming stem is encased by the firing-pin housing nut, which, in turn, is pinned to the firing-pin housing. To the bottom of the firing-pin housing is attached the slider stop. In addition, the firing pin is locked to the firing-pin housing by two balls, and the firing-pin housing, in turn, is locked to the ball-retainer sleeve by two balls. As the arming stem screws upward, the entire firing assembly moves upward under the action of the ball-retainer spring. After approximately 150 revolutions of the vanes, the firing assembly has risen sufficiently to withdraw the slider top and firing pin from the slider slot, allowing the slider to align its detonator below the firing pin. (A detent locks the slider in position.) Continued rotation of the vanes causes the O-ring gasket on the firing-pin housing nut to seat and stop rotation of the vane assembly.

On impact, the ball-retainer sleeve is forced down by the inertia freeing the retaining balls. At the instant deceleration ceases, the ball-retainer sleeve is forced upward by its spring, allowing the firing balls to jump out of their recess, and the spring-loaded striker is restrained only by the lead shear wire. The fuze is now fully armed. The firing pin, under action of its spring, exerts pressure on the lead shear wire

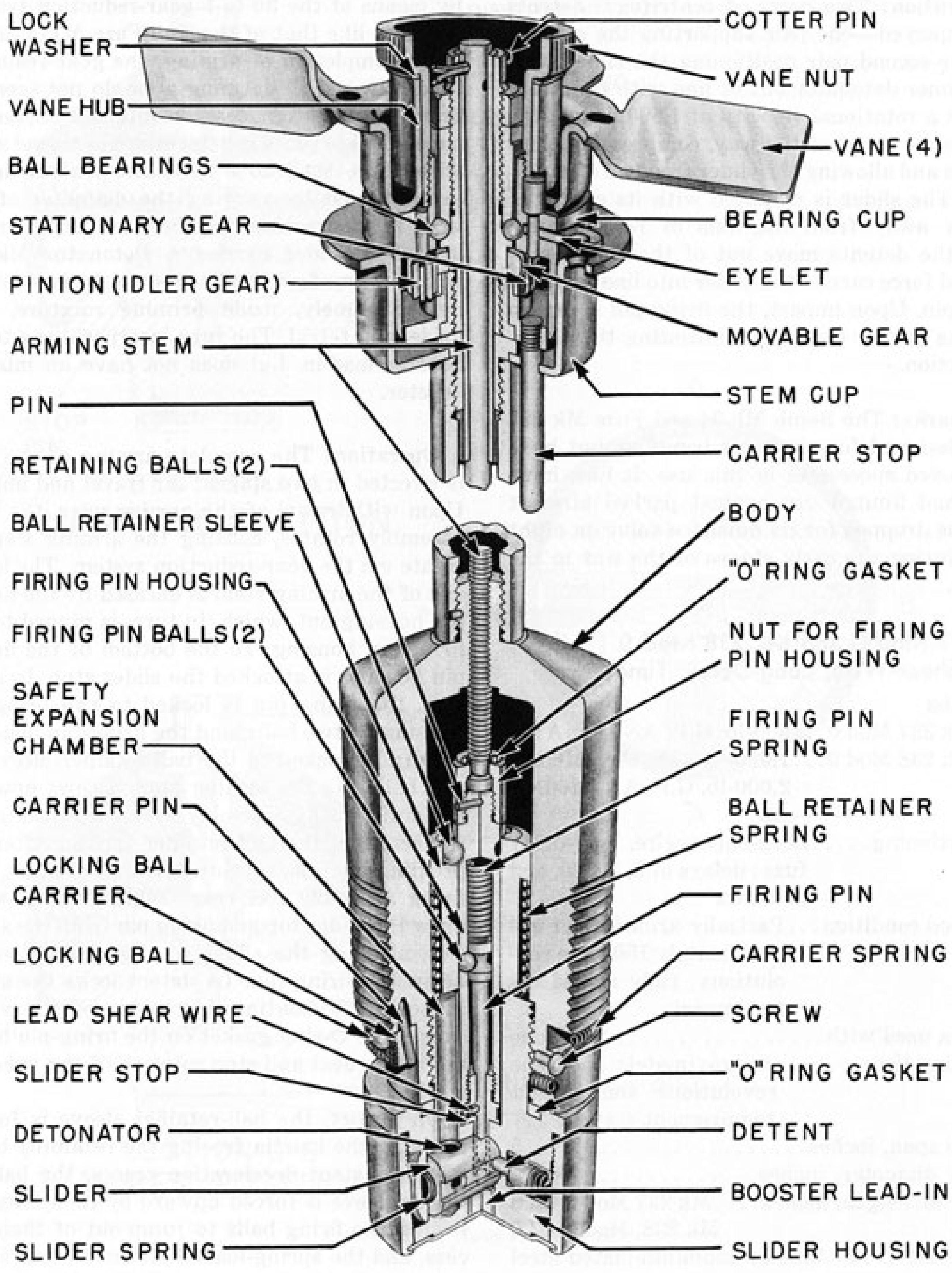


Figure 373. Long-Delay Tail Fuzes Mk 237 Mod 0 and Mk 238 Mod 0

and causes the wire to shear when the proper length of time has elapsed, depending on temperature conditions. The firing pin strikes the detonator, which, in turn, sets off the booster lead-in.

Remarks: These fuzes incorporate an anti-withdrawal feature, but no booby trap device like the M123 series. Under normal handling and installation, the anti-withdrawal feature does not function, since the locking ball and its carrier are held in place in the deep part of the eccentric groove, by a carrier pin and spring. Upon impact, however, the force of inertia is sufficient to withdraw the carrier pin from the fuze body, and allow the carrier spring to pull the ball carrier into the shallow part of the eccentric, locking the fuze in place. The fuze body is case-hardened to prevent removal with a wrench after impact. Since these fuzes require impact to lock in place, bombs with these fuzes can be safely returned to the base or carrier, and the fuzes removed for stowage.

Since these fuzes have a two-inch thread diameter, it is necessary to remove the inner sleeve of the Adapter Booster M115A1 before installation. Fuzes should be screwed securely into the adapter booster; otherwise a dud may result. A special short-length locking pin is shipped with these fuzes for securing the Adapter Booster M115A1 to the base plate.

Bombs fuzed with these fuzes should not be released at an altitude lower than that specified by the Chief of Naval Operations as the minimum safe altitude of release for instantaneous action fuzes; for, if the bomb is subjected to multiple impact, the first impact would completely arm the fuze, and the second might shear the lead shear wire, allowing the fuze to fire without delay.

These fuzes are detonator safe. In the unarmed position, the detonator is lined up with the safety expansion chamber. If the detonator should function prematurely, the force of detonation is dissipated in this cavity, and will not set off the booster lead-in charge, or adapter booster charge.

Part 6 — Chapter 20 — Section 4

IGNITER FUZES AND IGNITERS

Fuze M154, Igniters M13 and M14, and Experimental Types E3R1, E3R2, E3R4, E4R1, E4R2, E4R3, E4R4, E4R6, and E4R7

Bombs .... Jettisonable fuel tanks, incendiary-filled

	M13	M14
Type	External	Internal
Fuze	M154	M154
Burster	C8R1	C8R1
Cap	None	Supported
Functioning	Inst.	Inst.
Igniters used with	M16	M15

Armed condition .. If arming wire and retaining wire are missing

Arming time .... Armed when dropped

General: Thirteen igniters were developed simultaneously for use with the "fire bombs", of which four have been standardized—namely, the Igniters M13, M14, M15, and M16. The igniters of the M13 and M14 type use the Fuze M154, a modification of the Nose Fuze M142, the greatest emphasis being placed on the M13 and M14, which will eventually supplant all other igniters using the Fuze M154.

The Igniters M13 and M14 differ in that the M13 is designed to be attached to the outside of the bomb by means of a clamp, while the M14 has an adapter which allows the igniter to be installed in the filler-cap opening in the tank. Because of this difference, the M13 is known as an external igniter, while the M14 is called an internal igniter. The Igniters M13 and M14 consist of either a sodium (Na) or a white

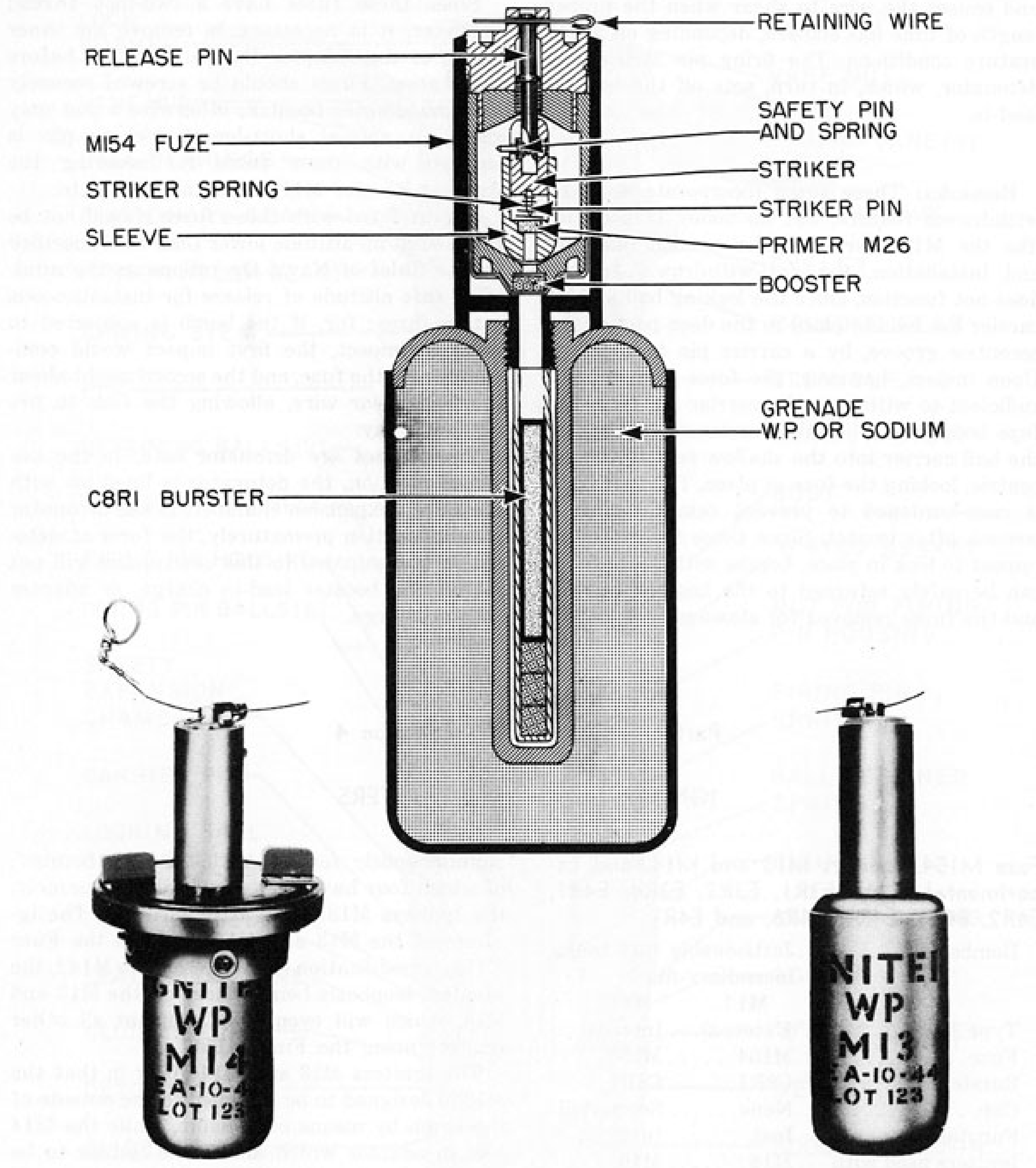


Figure 374. Igniters M13 and M14, and Cutaway Showing Fuze M154

phosphorus (W.P.) Hand Grenade M15 and a Burster C8R1 (DuPont C56 blasting cap and 2.5 grams of tetryl) fitted to an All-Ways Action Fuze M154.

If the bombs are to be dropped at sea, the Na grenade is used, while if the bombs are employed against land targets the W.P. grenade is attached. At the present time, the Na-filled Igniter M13 is restricted and the W.P.-filled M13 is to be dumped by Navy activities. Both the W.P.- and the Na-filled M14 are available. Neither the M13 nor the M14 is considered safe for carrier landings.

Operation: When the bomb is released, the arming wire is pulled, permitting the spring-loaded arming pin to move upward, thus allowing the safety pin to fly inward, arming the fuze. On impact, the striker pin and sleeve are forced together, igniting the Primer M26. Flash from the primer initiates the black powder booster and, latterly, the Burster C8R1, which, in turn, breaks the grenade case, allowing the W.P. or Na to ignite the incendiary mixture scattered by the bursting tank.

Modifications: The following are experimental igniters developed concurrently with the M13 and the M14.

The E3R1, E4R1, and E4R2 differ from the M13 and M14 respectively in that they use an Infallible Powder burster (similar to Ballistite) instead of the Burster C8R1 of the standardized models. In addition, the E4R1 has an unsupported cap instead of a supported one as in the M14 and the E4R2. The unsupported cap is a standard filling cap modified for use as an igniter. The supported cap is one specifically designed for the igniter. All three use the Fuze M154; they are restricted by the Navy to land-base training use only.

The E3R2, E4R3, and E4R4 differ from the M13 and M14 respectively in that they use a Burster C8, known commercially as the DuPont C56 blasting cap, instead of the C8R1, which is similar, except for a supplementary 2.5 grams of tetryl. In addition, the E4R4 has an unsupported rather than a supported cap as in the E4R2 and the M14. All three use the Fuze M154; for the Navy, the W.P.-filled igniters using the Burster C8 are unserviceable and should be dumped; and the Na-filled ones are restricted.

The E3R4 and the E4R7 differ from the M13 and M14 respectively in that they use the Fuze E9R20 rather than the M154. The E9R20 is an anemometer-arming all-ways action fuze converted from the Nose Fuze M154. The Burster C8R1 is present in both igniters, as in the M13 and M14, and the E4R7 has a supported cap. Both Na- and W.P.-filled igniters are unserviceable under Navy order and should be dumped.

The E4R6 is identical to the M14, except that it has an unsupported cap. It uses the Fuze M154 and has a Burster C8R1. The W.P.-filled E4R6 is to be dumped.

Remarks: The Igniter M15 is designed to be clamped externally to the tank or fin assembly at any convenient point at which a suitable clamp has been provided or improvised. In cases where no clamp has been provided, the local ordnance officer must ensure that the igniter is rigged in accordance with the best ordnance practice. The clamp must be installed so that the axis of the igniter is at 90° to the axis of the tank.

Fuze M157; Igniters M15 and M16

	M15	M16
Bombs	Jettisonable fuel tanks, incendiary-filled	
Type	External	Internal
Fuze	M157	M157
Burster	C8R1	C8R1
Cap	None	Supported
Functioning	Inst.	Inst.
Igniters used with	M14	M13
Armed condition	Any unthreading of M157	
Arming time	18-30 vane revolutions; 150-220 feet of air travel	

General: The igniters considered here use the Anemometer-Arming All-Ways Action Fuze M157. The Igniters M15 and M16 differ in that the M15 is designed to be attached to the outside of the bomb by means of a clamp, while the M16 has an adapter which allows the igniter to be installed in the filler-cap opening in the tank. Because of this difference, the M15 is known as an external; the M16, as an internal igniter.

The Igniters M15 and M16 consist of either a sodium (Na) or a white phosphorus (W.P.)

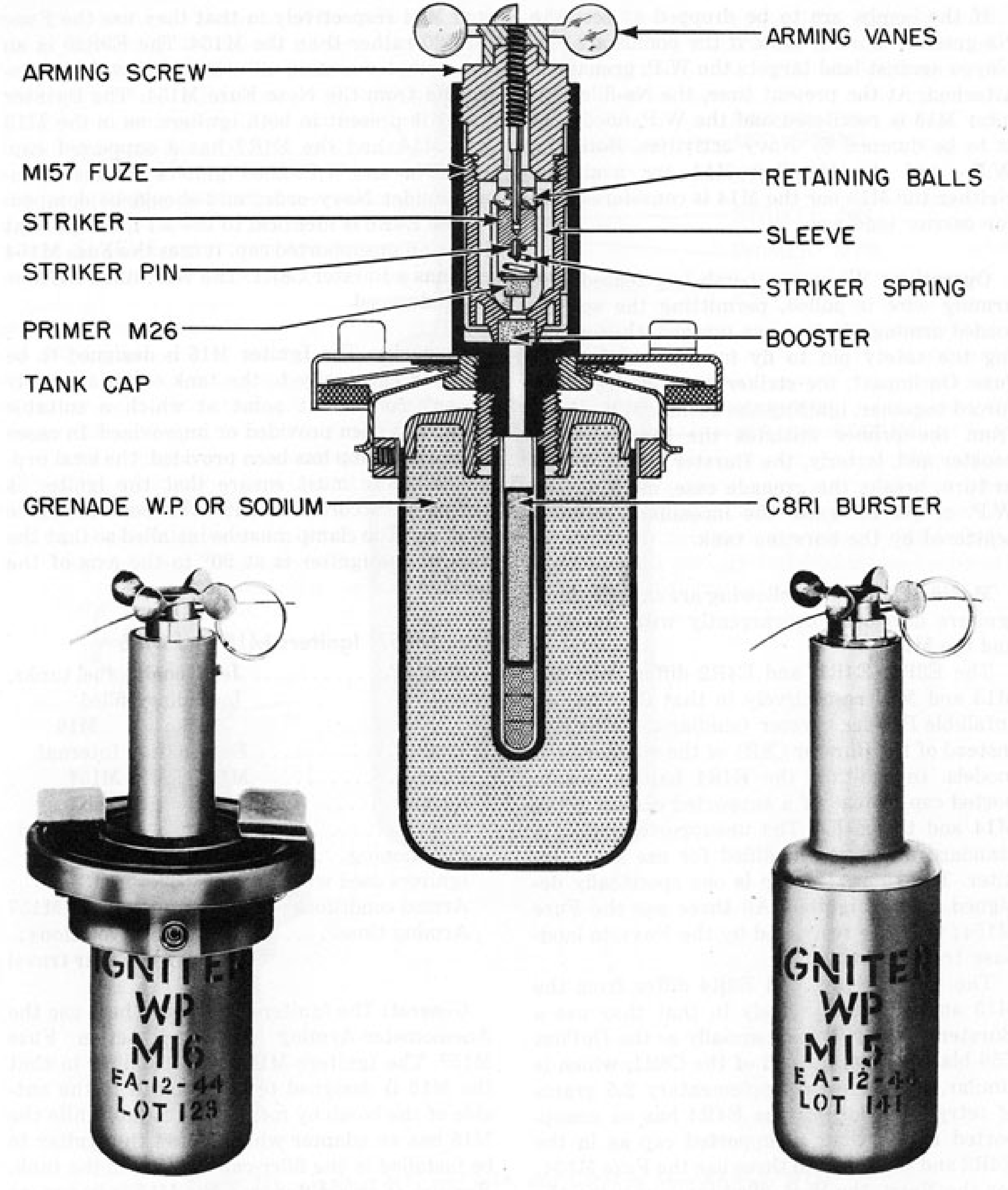


Figure 375. Igniters M15 and M16, and Cutaway Showing Fuze M157

Hand Grenade M15 and a Burster C8R1 (DuPont C56 blasting cap and 2.5 grams of tetryl) fitted to the Fuze M157. If the bombs are to be dropped at sea, the Na grenade is used, while if the bombs are employed against land targets, the W.P. grenade is attached. W.P.- and Na-filled Igniters M15 and M16 are available and are suitable for carrier use.

Operation: When the bomb is released, the arming wire is pulled, permitting the anemometer vanes to rotate. The rotation of the vanes threads the arming stem out of the fuze body; the fuze is armed when the stem clears the arming balls, allowing them to fall inward, freeing the striker for movement on impact. The arming assembly threads completely out of the fuze and falls away. On impact, the striker pin and sleeve are forced together, igniting the Primer M26. Flash from the primer initiates the black powder booster and, latterly, the Burster C8R1, which, in turn, breaks the grenade case, allowing the W.P. or Na to ignite the incendiary mixture scattered by the bursting tank.

Remarks: Even though the igniter is released safe and the fuze does not function, impact may break open the Grenade M15, scattering its white phosphorus or sodium filler. This will ignite the gasoline gel, just as though the burster had scattered the filler. For this reason, the igniter cannot be considered capable of "safe" dropping with absolute assurance of non-functioning.

The Igniter M15 is designed to be clamped externally to the tank or fin assembly at any convenient point at which a suitable clamp has been provided or improvised. In cases where no clamp has been provided, the local ordnance officer must ensure that the igniter is rigged in accordance with the best ordnance practice. The clamp must be installed so that the axis of the igniter is at 90° to the axis of the tank.

The supported cap is a cap specifically designed for use with an igniter.

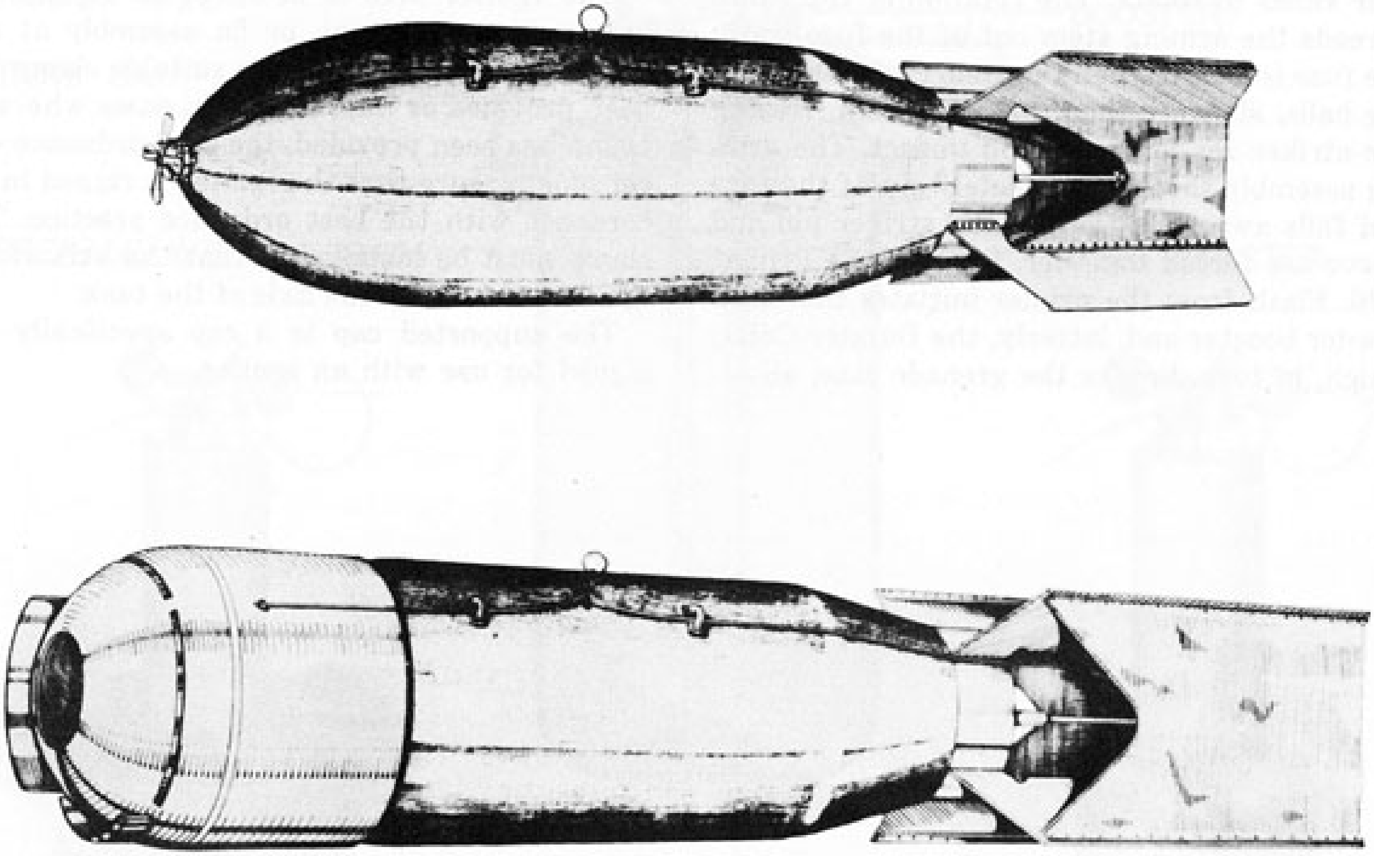


Figure 376. 1,000-pound G.P. Bomb AN-M65 (above) and Same Bomb Fitted with "Dove" Nose Attachment and Special Tail (below)

Part 7

GUIDED MISSILES AND FUZES

Chapter 21 — MISSILES

Section I — INTRODUCTION

General

One of the newest trends in American ordnance development, guided missiles became service items in the last months of World War II. Guidance was applied to modified bombs, winged glide bombs, and standard aircraft, and in jet- and rocket-propelled airframes.

Guided missiles have great range, high payload capacity and extreme accuracy; and their progress in design has proceeded so rapidly that on only a few items has the design become standardized or "frozen". All the missiles included in this book were at least in the testing stage and were being pursued as active projects at the time of writing. Furthermore, only those missiles designed for combat or military purposes—none of the basic research items—are included; and, of these, only their ordnance components can be described in detail.

Guidance

American missiles are usually guided by remote radio control, the receiver in the missile acting through servo units to position the air foils.

Intelligence

The person controlling the flight of the missile will guide its path on the basis of information obtained visually, through a television receiver, or by ordinary radar tracking. Some missiles have automatic guidance features, of such a nature that, once the target has been "shown" to the missile's intelligence unit, it will automatically "home on" to its destination unassisted.

Propulsion

Depending on the particular item, a missile may be powered by gravity, aircraft engines, JATO units, rocket motors, or jet motors.

Warheads

Thus far, guided missiles have adapted standard bombs as their explosive payloads. Fuzing of these bombs differs from the standard fuzes in that the fuzes must be made in an elbow shape, in order to fit in the fuze pockets and, at the same time, permit vane arming.

Cognizance

For the Navy, the Bureau of Ordnance and the Bureau of Aeronautics are developing guided missiles; for the Army, the Air Forces are in charge of the program.

BUREAU OF ORDNANCE MISSILES

1,200-pound "Dove" Bomb Mk 64 (Air-to-Surface Missile)

Over-all length, inches 84.5
Over-all diameter, inches 18.75
Weight of intelligence units and special tail, pounds 183
Warhead (1,000-pound G.P. Bomb AN–M65) weight, pounds 975
Total weight, pounds 1,160
Fuzing .... Tail Fuze AN–M102A2

General: The Bomb Mk 64 is an experimental heat-homing bomb, consisting of a detecting, computing, and guiding mechanism housed in a nose attachment fitted on the 1,000-pound G.P. Bomb AN–M65. It is designed for attack on maneuvering targets and is effectively employed in both high-angle and dive-bombing runs against objects which have sufficient thermal contrast to their background.

"Dove" is designed to fit the normal plane stowage, but carrying capacity is sometimes reduced because of the missile's increased length. The special Bomb Fin Mk 1 is a box-kite shape and eight inches longer than the standard tail for this bomb.

Control: Aerodynamic control is effected in range and azimuth by means of four movable nose deflectors independently controlled, which thus form quadrants of a cylindrical surface whose axis is parallel to that of the bomb. The deflectors may be extended a maximum distance of $4\frac{1}{2}$ inches. The movement of the deflectors is determined by the intelligence unit, which consists of the heat-detecting eye, gyro system, auxiliary electronic relays, servo motors, and battery.

Suspension: Standard.

1,600-pound "Bat" S.W.O.D. Mk 9 (Air-to-Surface Missile)

Over-all length, feet 11.9
Wing span, feet 10
Total weight, pounds 1,600
Warhead ... 1,000-pound G.P. Bomb AN–M65
Fuzing .... Nose—Mk 235 Mod 0
Tail—Mk 236 Mod 0

General: S.W.O.D. (Special Weapons Ordnance Device) Mk 9, or "Bat", is a glide bomb equipped with a radar homing set mounted in the nose. It is designed primarily for attacking marine targets, and is effective for night or day attacks upon shipping in any weather in which the parent plane can fly. The launching planes need not stay in the vicinity of the target, and may release as many as four of these missiles in salvo.

The airframe consists of plywood sections which are fitted around the Bomb AN–M65. Control surfaces consist of an elevon on each wing which can be moved to control pitch or bank. There are no control surfaces on the tail.

To ensure destruction of the intelligence system, the Demolition System Mk 122 is used.

Installation of the Fuzes Mk 235 and Mk 236, with their outside windmills and flexible arming stems, is standard.

Control: This missile has its own radar transmitter and receiver. When the target is located on the scope of the monitor unit in the plane, it is put into the range step of the missile's scope and is automatically kept there. At the correct instant, determined by a glide ratio scale, the missile is released and is guided to its target by the radar signal in its own scope. The guiding radar supplies corrections to the servo system, which is also controlled by a gyro pilot, the device which maintains flight attitude.

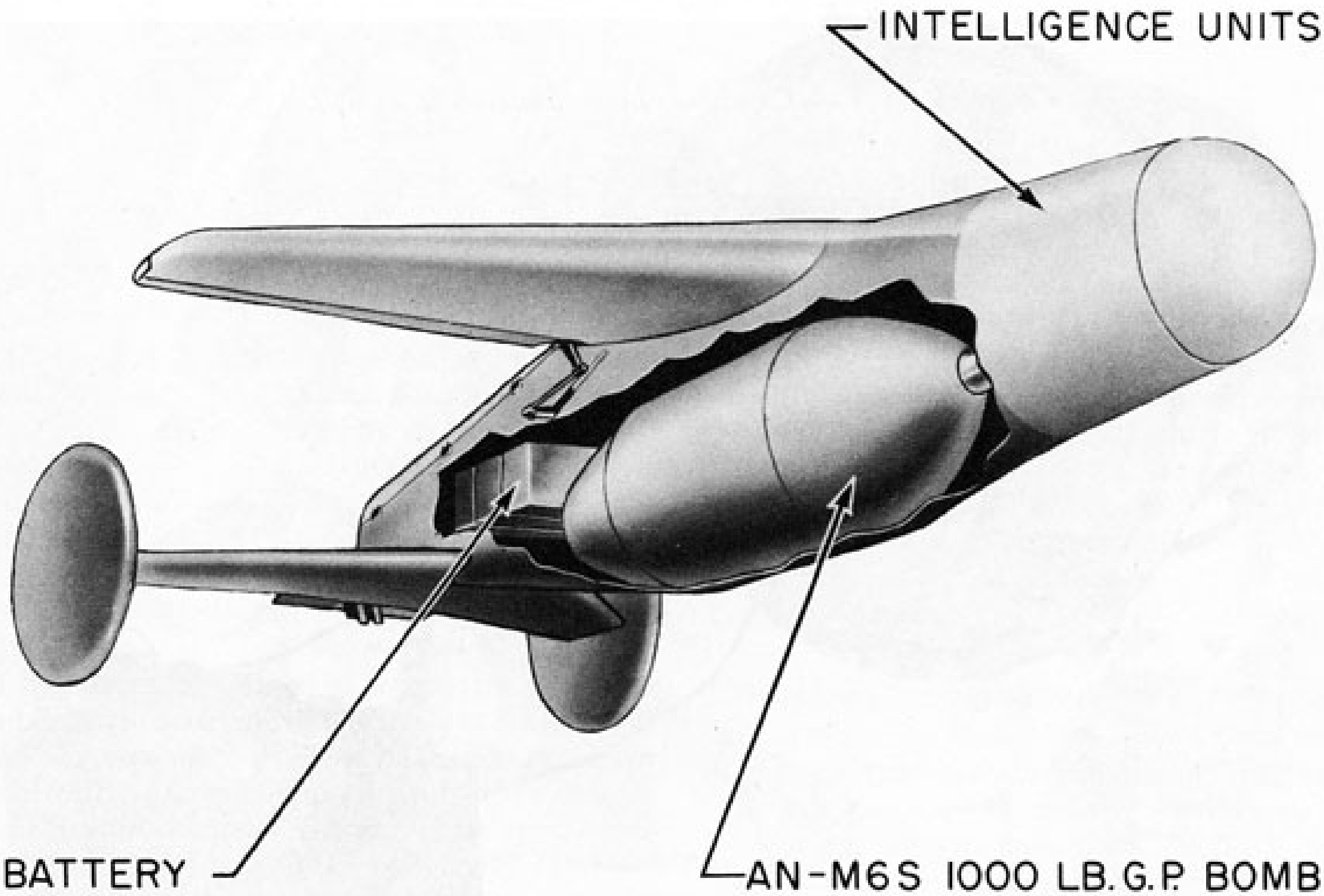


Figure 377. "Bat" Missile, Showing Location of Warhead

Suspension: Standard bomb lugs are employed on the airframe. Also, there is the multi-conductor cable connecting the missile's radar with the monitor set in the plane, known as the umbilical cord.

Demolition system: This destructor assembly consists of the S–122–11G switch, Junction Box Mk 1 Mod 0, primacord connectors, and ten Demolition Charges Mk 4. The S–122–11G switch incorporates an inertia weight, held by a spring tension of 11*g*, which will topple if that force is exceeded in an impact. When this inertia weight topples (it is mounted on a universal pivot) the contact bar, which has been transmitting the spring tension to the inertia weight, rotates because of the spring load and completes the electrical circuit across the contacts. This switch has an arming stem, connected to windmill vanes mounted on the outside of the missile fuselage, which unscrews to arm the switch. These vanes have an arming wire to prevent rotation before release from the parent aircraft. On one side of the switch is a clear plastic inspection port. Tension on the spring is pre-set at 11*g* when the switch is assembled at the factory.

When the switch completes the circuit, current from the battery sets off the electric blasting cap in the junction box, which fires the primacord connectors and then the TNT blocks, placed around the intelligence unit.

Remarks: The S.W.O.D. Mk 9 is commonly known as "the 1,000-pound Bat". The S.W.O.D. Mk 10, built around a 2,000-pound bomb is not being actively developed, because it is felt that the 1,000-pound size is large enough for currently projected uses.

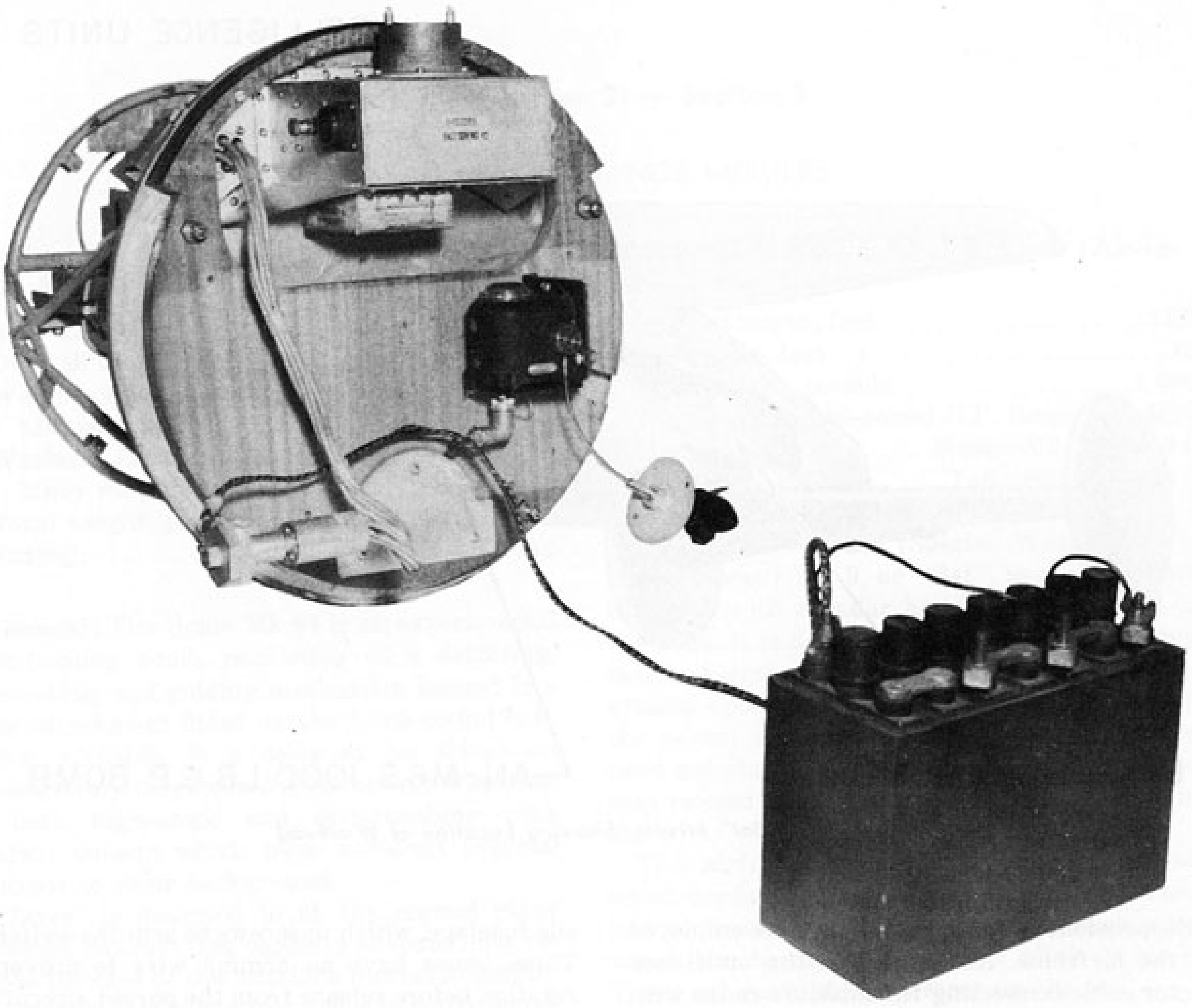


Figure 378. Battery, Inertia Switch, Junction Box and Connectors of Demolition System Mk 122

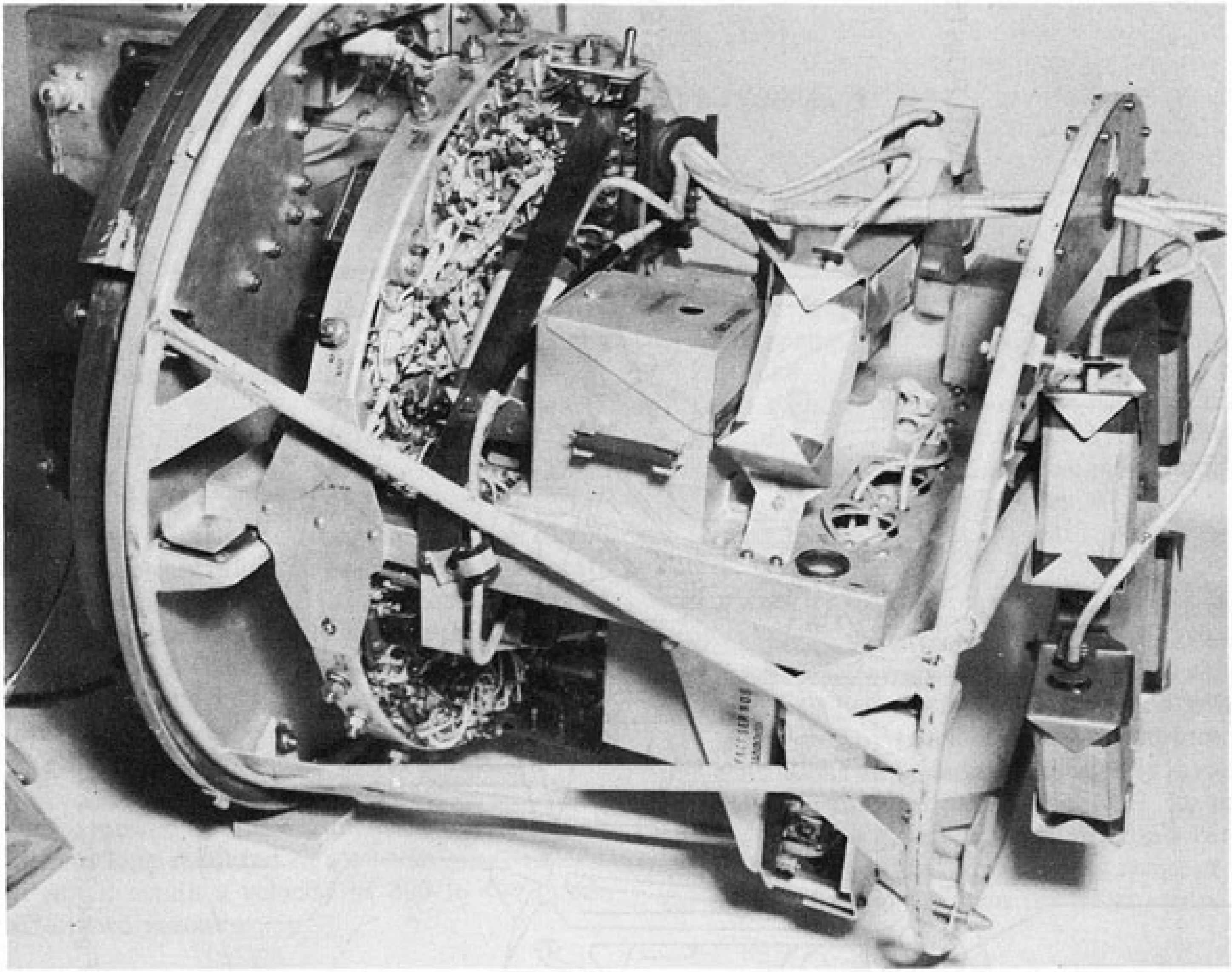


Figure 379. Location of TNT Blocks in Demolition System Mk 122

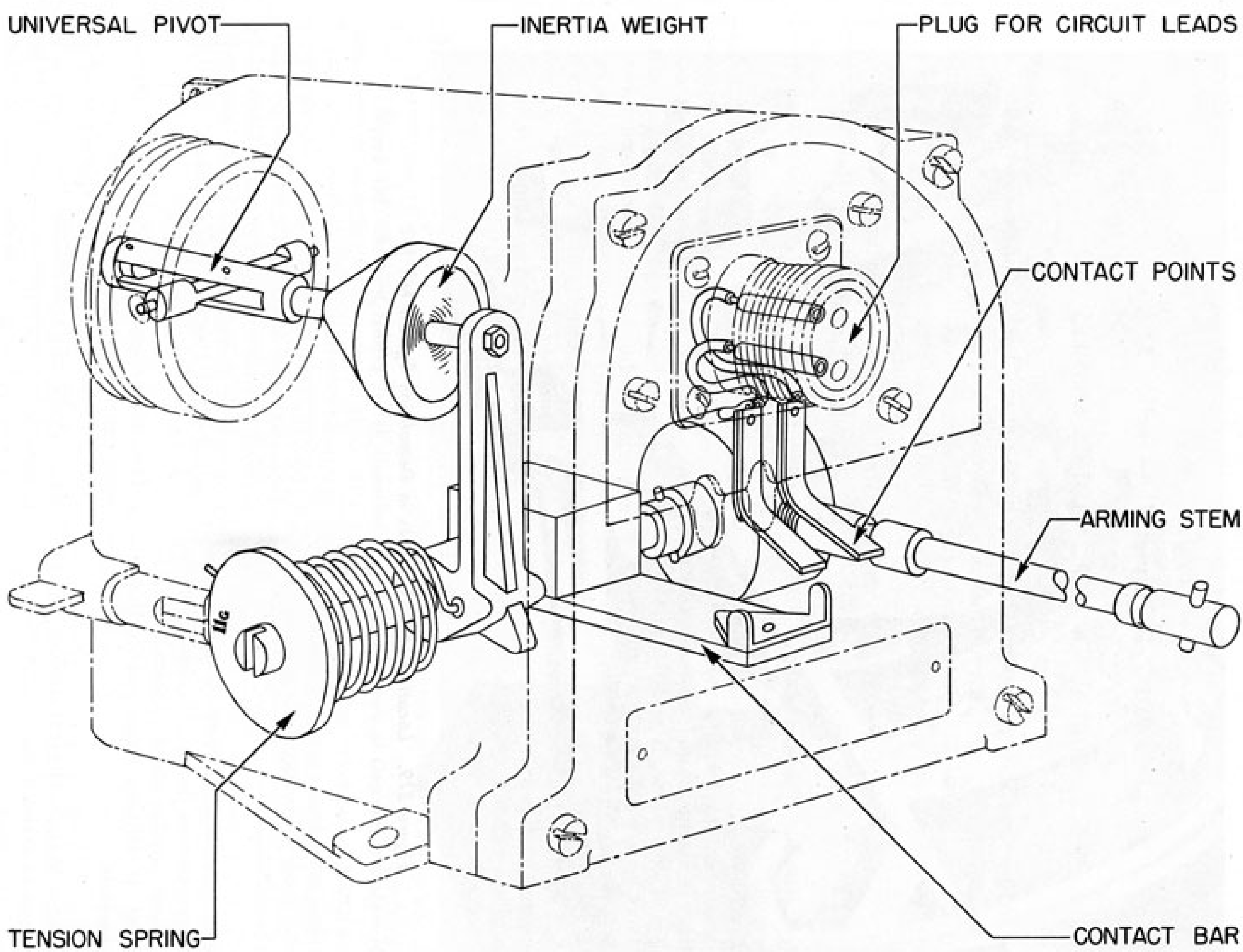


Figure 380. S–122–11G Inertia Switch

BUREAU OF AERONAUTICS MISSILES

"Little Joe" 650-pound Surface-to-Air Missile

Over-all length	8 feet 6 inches
Span	4 feet 9 inches
Total weight, pounds	4 rockets—591 6 rockets—651
Warhead	100-pound G.P. Bomb AN–M30
Fuzing	V.T. M166

General: "Little Joe" is a short-range (10,000 foot) radio-controlled, flare-sighted antiaircraft missile with a 100-pound G.P. warhead, launched from a shipboard catapult with the aid of standard rockets. A Canard-type airframe with cruciform wing and bow plane, it was designed to intercept Baka-type bombs and suicide planes. The missile is powered by a JATO unit.

The missile would be launched from a catapult 20 feet long mounted in a 40-mm gun position. It would attain a velocity of 300 to 400 m.p.h. after two seconds.

Control: By observing the flare track, the launcher guides the missile to its target with radio signals sent to the receiver in "Little Joe". The AN/ARW–17 receiver actuates signals which, in turn, operate the servo mechanisms to position the control surfaces. A gyro system provides the stability.

Propulsion: An 8AS1000 E JATO unit serves as the main propulsive motor. This unit weighs 139 pounds and contains about 75 pounds of Galcit propellant. It delivers 1,000 pounds thrust for eight seconds.

Four or six 3.25-inch Aircraft Rocket Motors Mk 7 are used to assist in launching.

Warhead: The 100-pound bomb has only the V.T. fuze.

1,400-pound "Lark" Ship-to-Air Missile

Over-all length	12 feet 6 inches
Wing span	6 feet 2 inches
Tail span	4 feet
Total weight, pounds	1,361
Warhead	Undetermined; probably a specially designed fragmentation head
Fuzing	Still experimental

General: The "Lark" is launched from a ship board catapult for attacking high-altitude bombers. It has cruciform wings and tail surfaces, the tail surfaces being offset 45° from the wings, and is powered by two liquid-fuel rocket motors, one continuous and one intermittent. It is radio-controlled in the first part of its flight, its position determined by the launching ship's radar. When it comes within radar homing range of the target, the homing mechanism takes control.

It is launched at 150 m.p.h. from a multiple-charge shipboard catapult by means of two 12AS1000 F JATO units which are jettisoned after exhaustion. With a range of 80,000 yards, an optimum ceiling of 30,000 feet, and a rate of climb of 8,200 feet per minute, it may develop a maximum speed of 650 m.p.h. Designed strength permits a maximum lateral acceleration of $4g$. Slant range is estimated to be 45 miles, with time of flight of about five minutes.

Control: By use of the ship radar intelligence, radio control will maintain the missile in the center of the tracking radar beam during the initial phase of flight. When the range of the automatic homing radar is reached, it will take over and navigate a collision course with the target. Both remote radio control and radar homing devices are connected to control surfaces

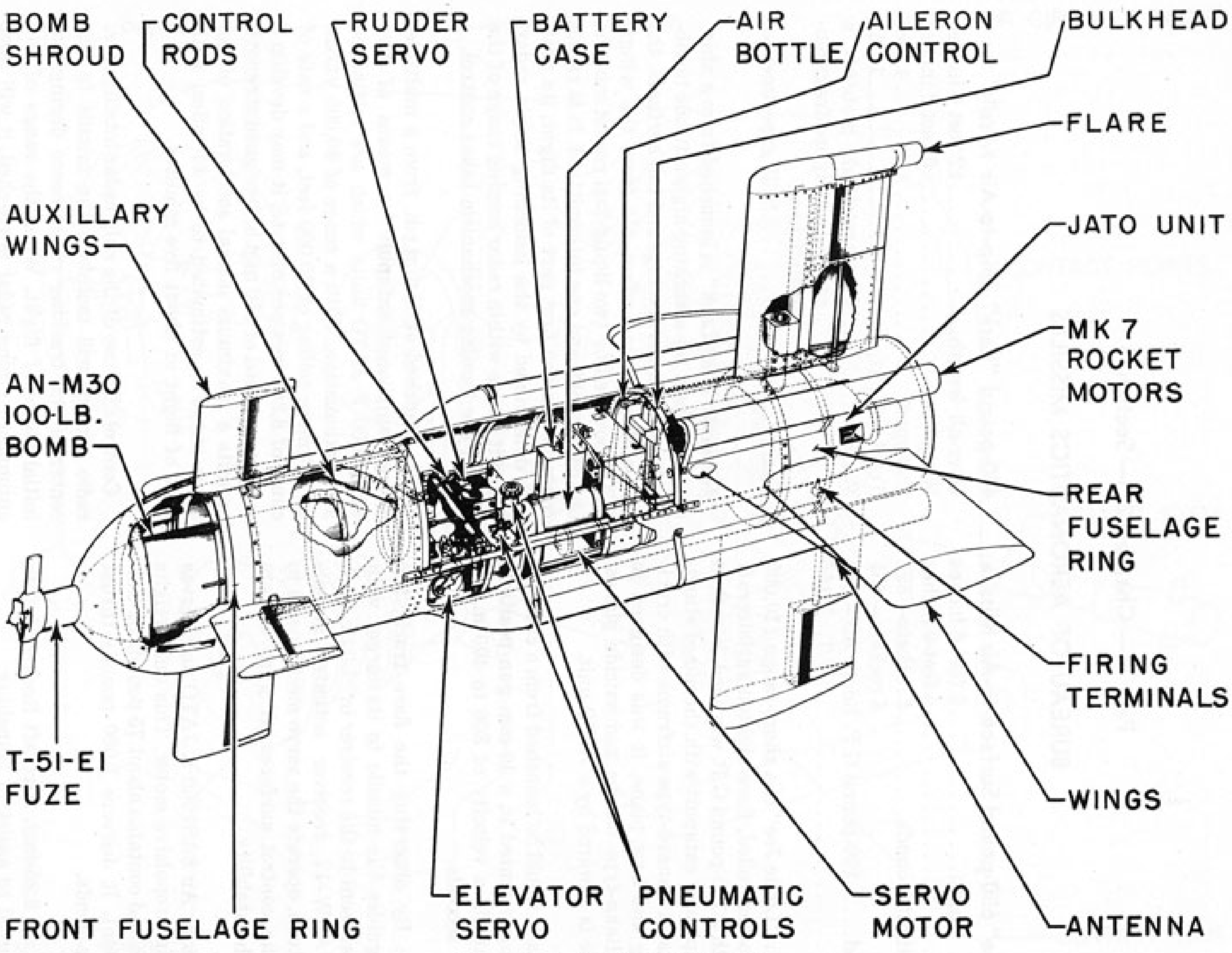


Figure 381. "Little Joe" Missile

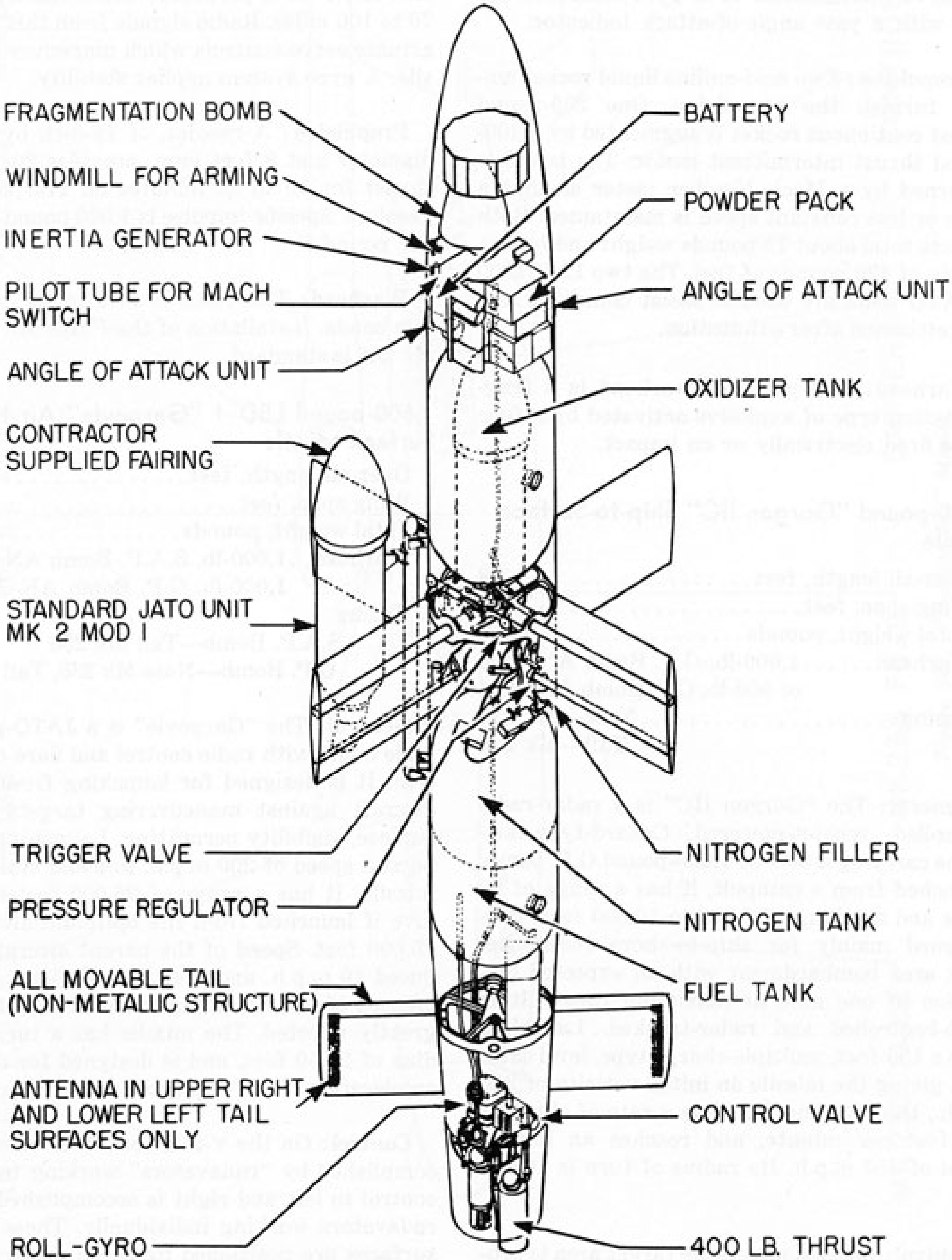


Figure 382. "Lark" Missile

by servo mechanisms. It is gyro-stabilized for roll, with a yaw angle-of-attack indicator.

Propulsion: Two acid-aniline liquid rocket motors furnish the propulsion. One 200-pound thrust continuous rocket is augmented by a 400-pound thrust intermittent motor. The latter is governed by a Mach Number meter so that a more or less constant speed is maintained. Both rockets total about 75 pounds weight and have a supply of 490 pounds of fuel. The two 12AS1000 F JATO units are used to assist launching and are jettisoned after exhaustion.

Warhead: The proposed warhead is a fragmentation type of explosive activated by a fuse to be fired electrically or on impact.

1,700-pound "Gorgon IIC" Ship-to-Surface Missile

Over-all length, feet	18
Wing span, feet	11
Total weight, pounds	1,688
Warhead	1,000-lb. G.P. Bomb AN–M65 or 500-lb. G.P. Bomb AN–M64
Fuzing	Nose—Mk 235 Tail—Mk 236

General: The "Gorgon IIC" is a radar-radio controlled, resojet-powered, Canard-type airframe carrying a 500- or 1,000-pound G.P. bomb. Launched from a catapult, it has a range of 90 miles and a ceiling of 8,000 to 10,000 feet. It is designed mainly for ship-to-shore round-the-clock area bombardment with an expected dispersion of one mile at maximum range. It is radio-controlled and radar-tracked. Launched from a 150-foot, multiple-charge type, level catapult, giving the missile an initial velocity of 240 m.p.h., the "Gorgon IIC" has a rate of climb of 600 feet per minute, and reaches an impact speed of 450 m.p.h. Its radius of turn is 10,000 feet.

Control: Intelligence on the target area is provided by AN/APN–33 A1 radar, range 70 miles. Radio control of the missile is accomplished by the receiver AN/ARW–17 (for combat the AN/ARW–37 is proposed) which has a range of 70 to 100 miles. Radio signals from this receiver actuate servo controls which maneuver the missile. A gyro system applies stability.

Propulsion: A resojet, of 14-inch by 10-inch diameter and 9 feet long, provides 200 pounds thrust for 10 to 20 minutes on 174 pounds of gasoline. Specific impulse is 1,030 pound-seconds per pound.

Warhead: The bomb is held in its cradle by two bands. Installation of the Fuzes Mk 235 and Mk 236 is standard.

1,600-pound LBD–1 "Gargoyle" Air-to-Surface Missile

Over-all length, feet	10
Wing span, feet	8½
Total weight, pounds	1,646
Warhead	1,000-lb. S.A.P. Bomb AN–M59 or 1,000-lb. G.P. Bomb AN–M65

Fuzing

S.A.P. Bomb—Tail Mk 236

G.P. Bomb—Nose Mk 235, Tail Mk 236

General: The "Gargoyle" is a JATO-powered glide bomb with radio control and flare observation. It is designed for launching from carrier aircraft against maneuvering targets on the surface, visibility permitting. Launching should be at a speed of 200 m.p.h. to avoid stalling the missile. It has a range of 26,000 feet in a 30° dive if launched from the optimum altitude of 15,000 feet. Speed of the parent aircraft is reduced 10 m.p.h. and the take-off distance is increased 15 to 80 feet, but maneuverability is not greatly affected. The missile has a turning radius of 2,550 feet, and is designed for a lateral acceleration of 4*g*. Top speed: 600 m.p.h.

Control: On the V-tail, control in pitch is accomplished by "rudavators" working together; control to left and right is accomplished by the rudavators working individually. These control surfaces are positioned by servo motors which take their signal from the radio receiver. The receiver, AN/ARW–17 (the AN/ARW–37 is proposed for combat) weighs 20 pounds and has

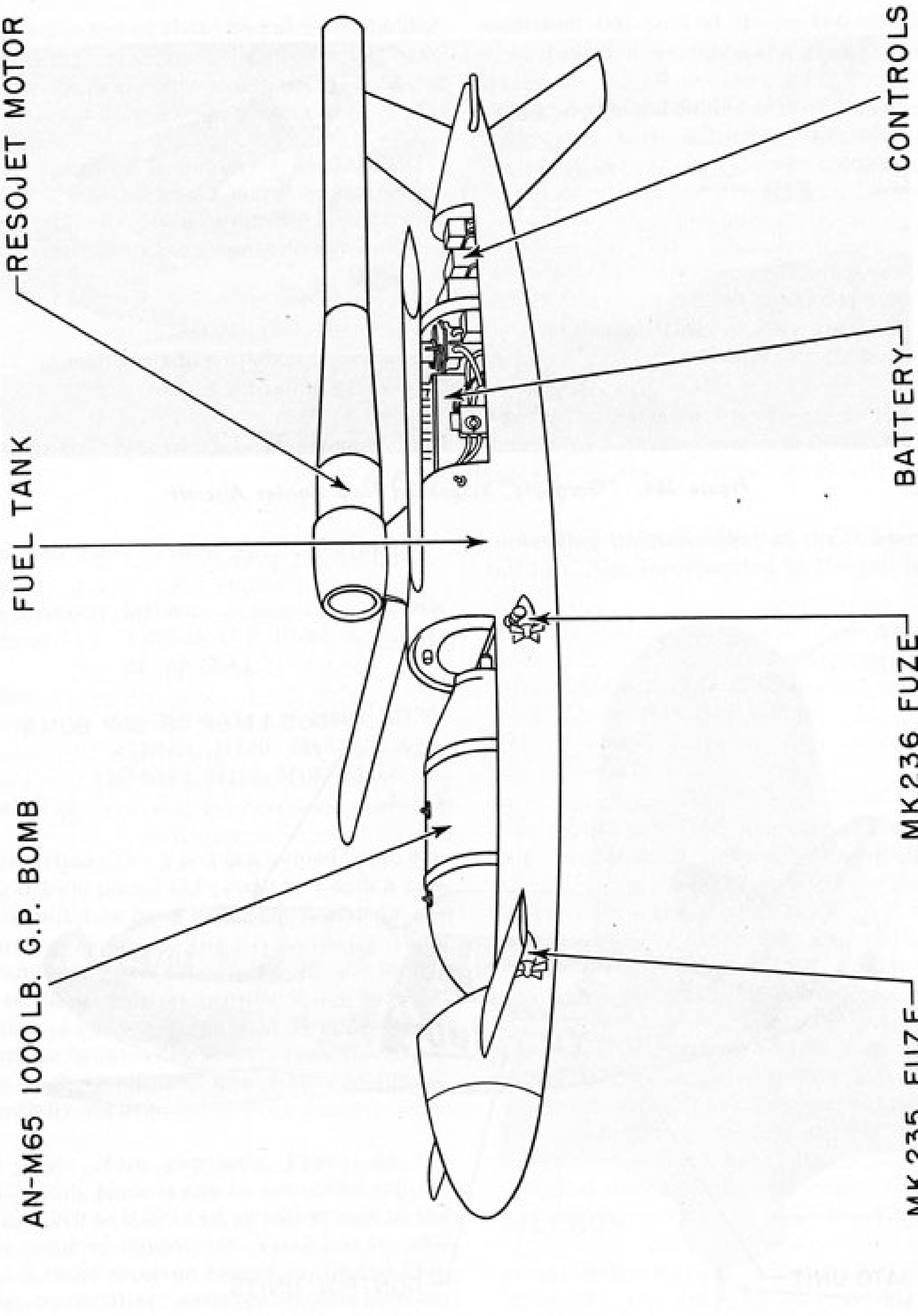


Figure 383. "Gorgon IIC" Missile

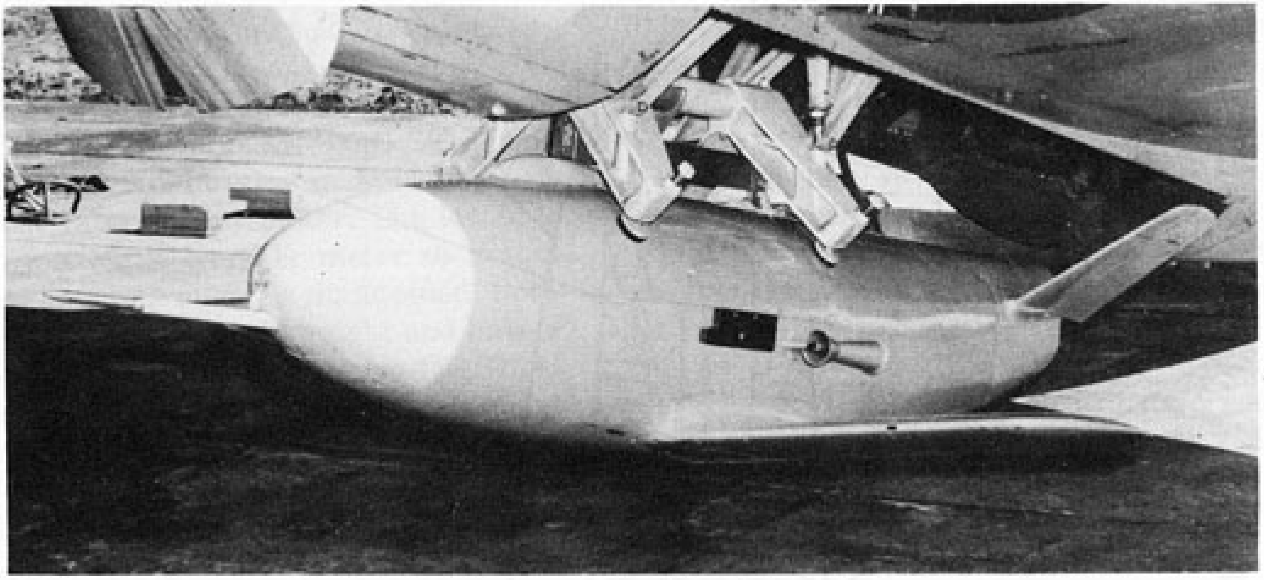


Figure 384. "Gargoyle" Suspended from Carrier Aircraft

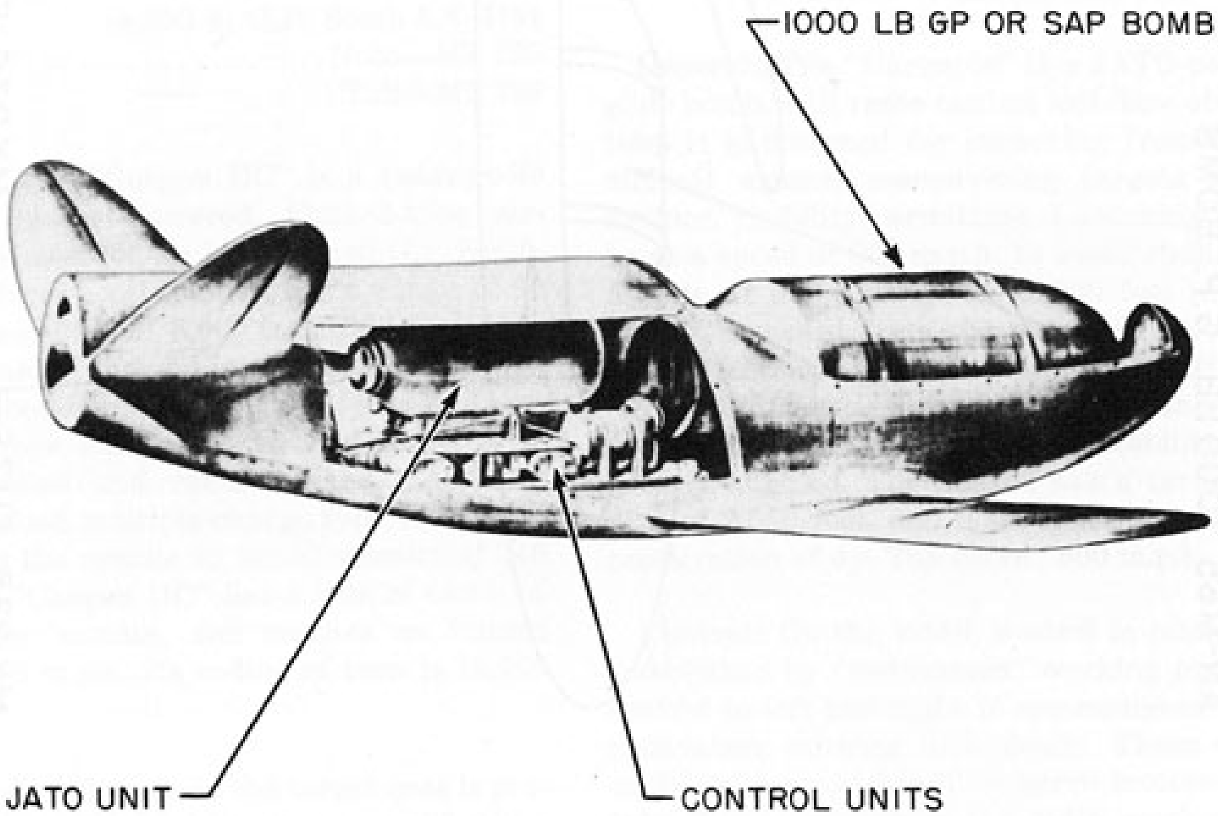


Figure 385. "Gargoyle" with Panels Removed

an estimated range of about 28 miles, depending on the antenna employed. Weight of servo system: 125.6 pounds.

Power: A standard 8AS1000 JATO unit, weighing 150 pounds, provides a propulsive thrust of 1,000 pounds for eight seconds. The fuel is 80 pounds of solid Galcit 63C propellant contained in a 9½ by 28⅞-inch casing.

Suspension: Exact specifications are not now available; but in test drops D-6 shackle and sway braces were employed (see figure 384). When the G.P. bomb is used, two steel straps 1/16 inch by 1/2 inch through the suspension lugs on the bomb hold it to the cradle. If the S.A.P. bomb is loaded, a strap through the single British suspension lug is used; also, an adapter block is placed in the cradle to provide a snug fit for the smaller diameter of the S.A.P. bomb.

Part 7 — Chapter 21 — Section 4

A.A.F. MISSILES

1,000-pound VB–1 "Azon" Air-to-Surface Missile

Body diameter, inches 18.8
Warhead . . . . . . 1,000-lb. G.P. Bomb AN–M44, 65, or 65A1
Fuzing
  Nose AN–M103A1, AN–M103, M139, M139A1, M140, M140A1, AN–M140A1, M163, M164, M165
  Tail M167

Construction: The VB–1 is a guided bomb employing a 1000-pound G.P. body to which a special tail unit has been attached, replacing the standard tail assembly. The VB stands for "Vertical Bomb" and indicates that the bomb is normally released from high altitude by use of a conventional bombsight and that the guided action for the bomb is relatively small, so that direction of the trajectory at the time of impact is essentially vertical.

Tail unit: More popularly known as the "Azon" bomb, since it can be controlled only in azimuth 2,000 to 3,000 feet on either side of the normal point of impact, the VB–1 has its controls in a radio receiver housed in the tail unit. A radio transmitter, operated by the bombardier in the parent aircraft, sends signals to the receiver, which, in turn, activates a servo motor controlling the movement of the rudders in the tail fins. Also incorporated in the tail is a gyro

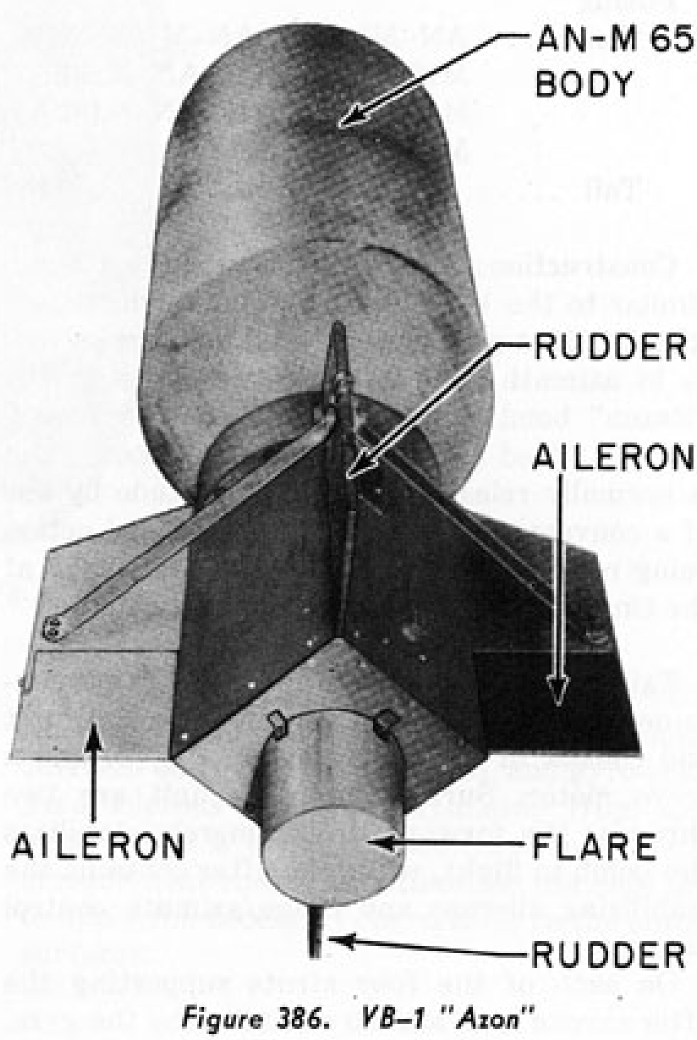


Figure 386. VB–1 "Azon"

and solenoid system which prevents the bomb from spinning by changing the pitch of the small ailerons in the fins.

Guide flares attached to the after end of the tail unit assist the bombardier in following the flight of the VB–1. Three flares, the T6E1 (white), T7E1 (red), and T8E1 (green) with an intensity of 1,000,000 candlepower each, are electrically armed and ignited three to four seconds after release, and burn from one to two minutes. Three mechanically armed and ignited flares, T21, T22, and T23 are under development.

Suspension: Suspension lugs are welded to the case in a manner similar to the G.P. bombs.

1,000-pound VB–3 "Razon" Air-to-Surface Missile

Body diameter, inches.................18.8
Warhead......1,000-lb. G.P. Bomb AN–M44, 65, or 65A1
Fuzing
Nose......AN–M103A1, AN–M103, M103, M139, M139A1, AN–M139A1, M140, M140A1, AN–M140A1, M163, M164, M165
Tail..............................M167

Construction: The VB–3 is a guided bomb similar to the VB–1, with the major difference that its flight may be controlled in range as well as in azimuth, and is known generally as the "Razon" bomb. Like the VB–1, it has special tail unit fitted to a 1,000-pound G.P. body, and is normally released from high altitude by use of a conventional bombsight, the guided action being relatively small, so that the trajectory at the time of impact is essentially vertical.

Tail unit: The controls for the VB–3 are contained in the cylindrical section of the tail unit and consist of a radio receiver, a gyro, and a servo motor. Surrounding this unit are two shrouds; the forward shroud merely stabilizes the bomb in flight, while the after contains the stabilizing ailerons and range/azimuth control ailerons.

On each of the four struts supporting the after shroud is an aileron controlled by the gyro. These four ailerons steady the bomb and prevent it from rotating while in flight. They are set 90° apart and operate in pairs; i.e., those ailerons placed opposite to each other move together in unison.

Four more ailerons are located on the outer surface of the after shroud. These are ailerons which control the trajectory of the bomb and adjust its flight in azimuth and range. They also work in pairs, and are operated by connecting rods which pass through the control unit and are activated by the servo motor. At present, two bombardiers are required with the VB–3 bomb; one controls range and the other azimuth. They work independently of each other and, by use of a special bombsight, they are always able to see the bomb in flight, superimposed on the target. As the bombardiers manipulate their control switches, radio waves are sent to the receiving unit in the tail. This unit activates the servo motor, which, in turn, moves the ailerons on the shroud, altering the flight of the bomb.

As in the VB–1, flares are employed to assist the bombardier in the visual control of the flight of the bomb. Currently used flares are the T6E1 (white), T7E1 (red), and T8E1 (green). They are of 1,000,000 candlepower, electrically ignited three to four seconds after release, and with one to two minutes of burning time. Mechanically-activated flares—T21, T22, and T23—are under development.

Suspension: Suspension lugs are welded to the case in a manner similar to the G.P. bombs.

1,200-pound VB–6 "Felix" Air-to-Surface Missile

Over-all length, inches................91.2
Over-all diameter, inches..............18.6
Total weight, pounds..................1,202
Warhead......1,000-lb. G.P. Bomb AN–M65
Fuzing........................Nose—T85
Tail—M167

General: The VB–6 is a heat-homing, high-angle bomb for attack against targets which give higher heat radiation than the surrounding areas. An added nose (84 pounds) and special tail assembly (143 pounds) carried on a stand-

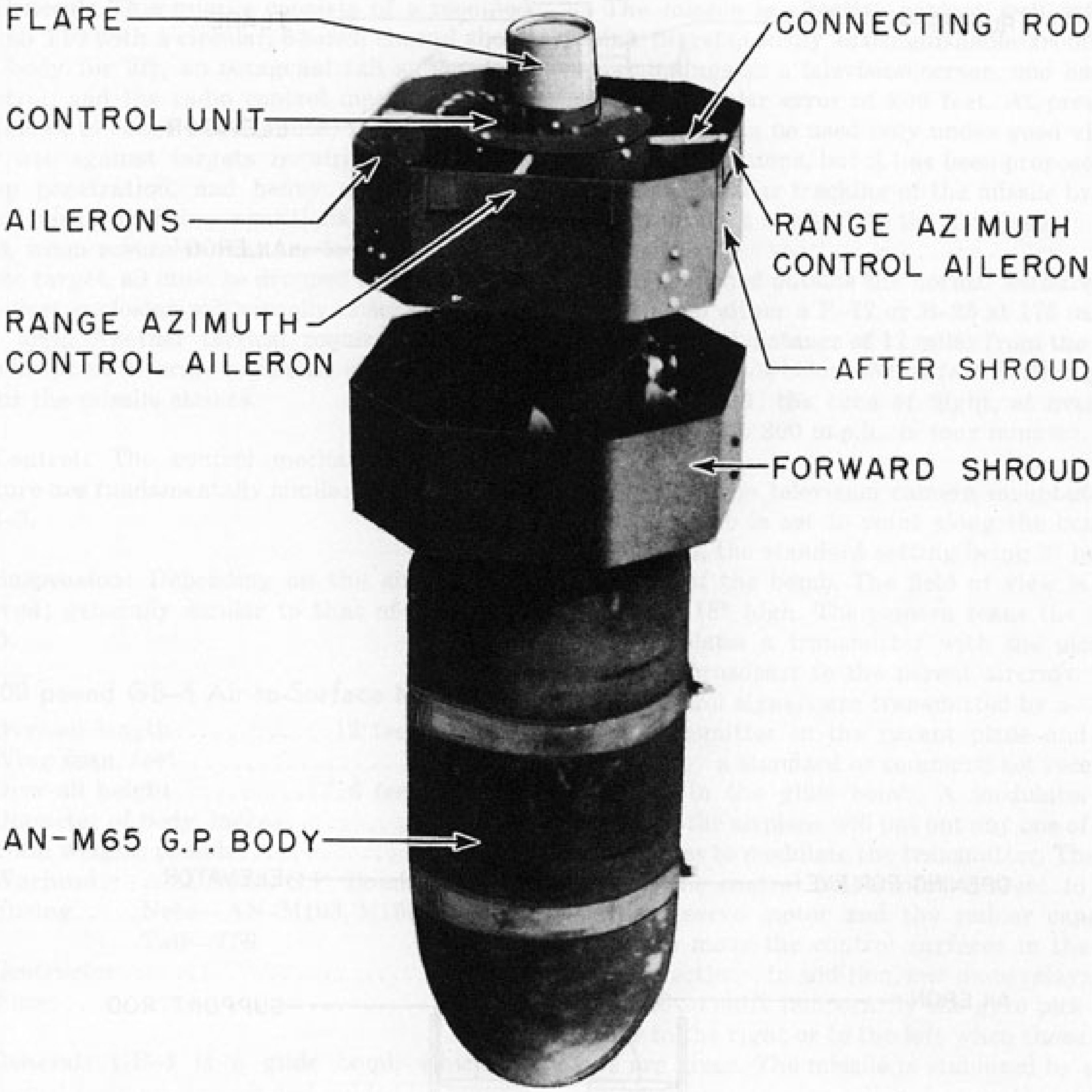


Figure 387. VB-3 "Razon"

ard 1,000-pound G.P. Bomb AN–M65 contain the heat-seeking equipment and the mechanism which operates the airfoil controls. Requisites for proper performance are clear weather and a target which has necessary heat-radiation quality. The bomb is sighted and released by standard Norden procedure.

Control: The tail assembly, which resembles that of VB–3, has range and azimuth control surfaces on an octagonal shroud, and gyro-stabilized ailerons to keep the missile from spinning. When a target passes into view, the increased heat radiations stimulate the nose unit to apply the necessary corrections to the shroud surfaces.

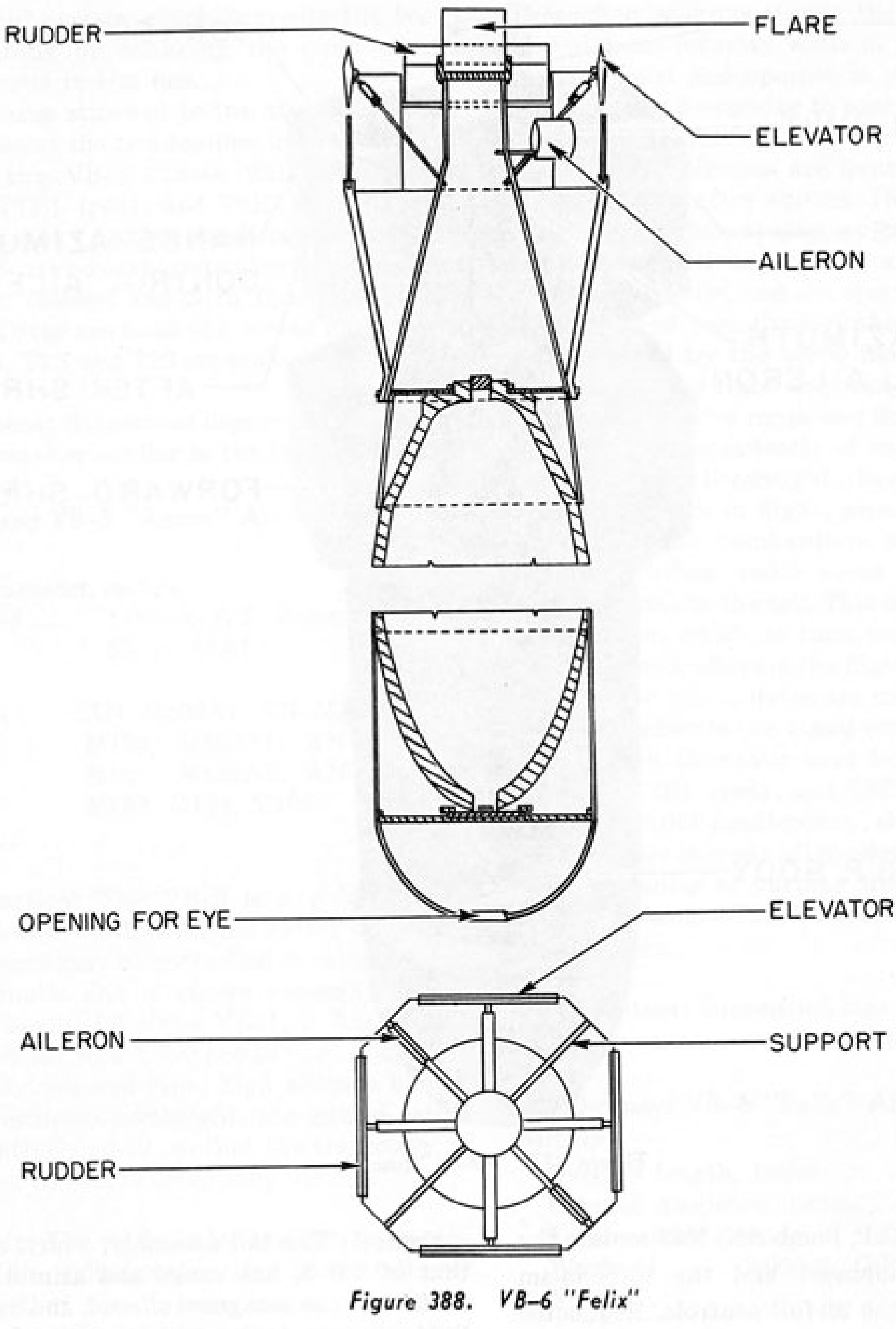


Figure 388. VB–6 "Felix"

Suspension: Standard lugs.

Remarks: The Nose Fuze T85 has a special plate attached to it, on which the nose assembly is bolted.

12,000-pound VB–13 "Tarzon" Air-to-Surface Missile

Over-all length, feet.................... 21
Warhead..........12,000-lb. G.P. Bomb T10
Fuzing............Three Fuzes T723 in tail

General: This missile consists of a modified Bomb T10 with a circular, 54-inch shroud about its body for lift, an octagonal tail surface for control, and the radio control mechanisms for guidance in range and azimuth. It is well suited for use against targets requiring direct hits, deep penetration, and heavy explosive loads. Good visual bombing conditions are necessary, and, when several bombs are to be used on the same target, all must be dropped together, since the first explosion will visually obscure the target area. Another tactical requirement is for the dropping aircraft to remain on its bomb run until the missile strikes.

Control: The control mechanism and procedure are fundamentally similar to those of the VB–3.

Suspension: Depending on the aircraft employed; generally similar to that of the Bomb T10.

2,500-pound GB–4 Air-to-Surface Missile

Over-all length	12 feet 2 inches
Wing span, feet	12
Over-all height	6 feet 2 inches
Diameter of body, inches	24
Total weight, pounds	2,536
Warhead	2,000-lb. G.P. Bomb AN–M66
Fuzing	Nose—AN–M103, M139, or M140 Tail—T59
Destructor	T9
Fuze	T62

General: GB–4 is a glide bomb which is launched from an aircraft and guided by remote radio control to its surface target by employing television intelligence picked up by a television camera on the missile and radioed to a receiver in the launching plane. It has a special plywood airframe built around a 2,000-pound bomb, with rudders and elevators but no ailerons. The airframe is fastened to a magnesium casting threaded to the tail of the bomb.

The missile is effective against well defined point targets, easily distinguishable from the surroundings on a television screen, and has an average circular error of 200 feet. At present, the weapon can be used only under good visual bombing conditions, but it has been proposed to incorporate radar tracking of the missile by the parent aircraft to alleviate the handicap.

It is launched outside the normal antiaircraft range from either a B–17 or B–25 at 175 m.p.h. at a preferred distance of 17 miles from the target at an altitude below 15,000 feet. With a glide ratio of 6 to 1, the time of flight, at average rates of 250 to 300 m.p.h., is four minutes.

Control: The television camera mounted under the bomb is set to point along the bomb's flight path, the standard setting being 3° below the axis of the bomb. The field of view is 14° wide and 18° high. The camera scans the area and modulates a transmitter with the picture which is broadcast to the parent aircraft. The radio control signals are transmitted by a "liaison" transmitter in the parent plane and are received by a standard or command set receiver installed in the glide bomb. A modulator installed in the airplane will put out any one of five audio tones to modulate the transmitter. The relays in the control unit switch current to the elevator servo motor and the rudder capstan motor to move the control surfaces in the desired directions. In addition, two more relays are actuated to shift temporarily the gyro pick-offs either to the right or to the left when those signals are given. The missile is stabilized by a directional gyro to give roll and azimuth control.

Suspension: The missile is carried outside the plane on a Shackle D7. Electrical cables, connected to it, pull out on release.

Destructor: The Destructor T9 is placed in the control box and is actuated, on impact, by the Fuze T62.

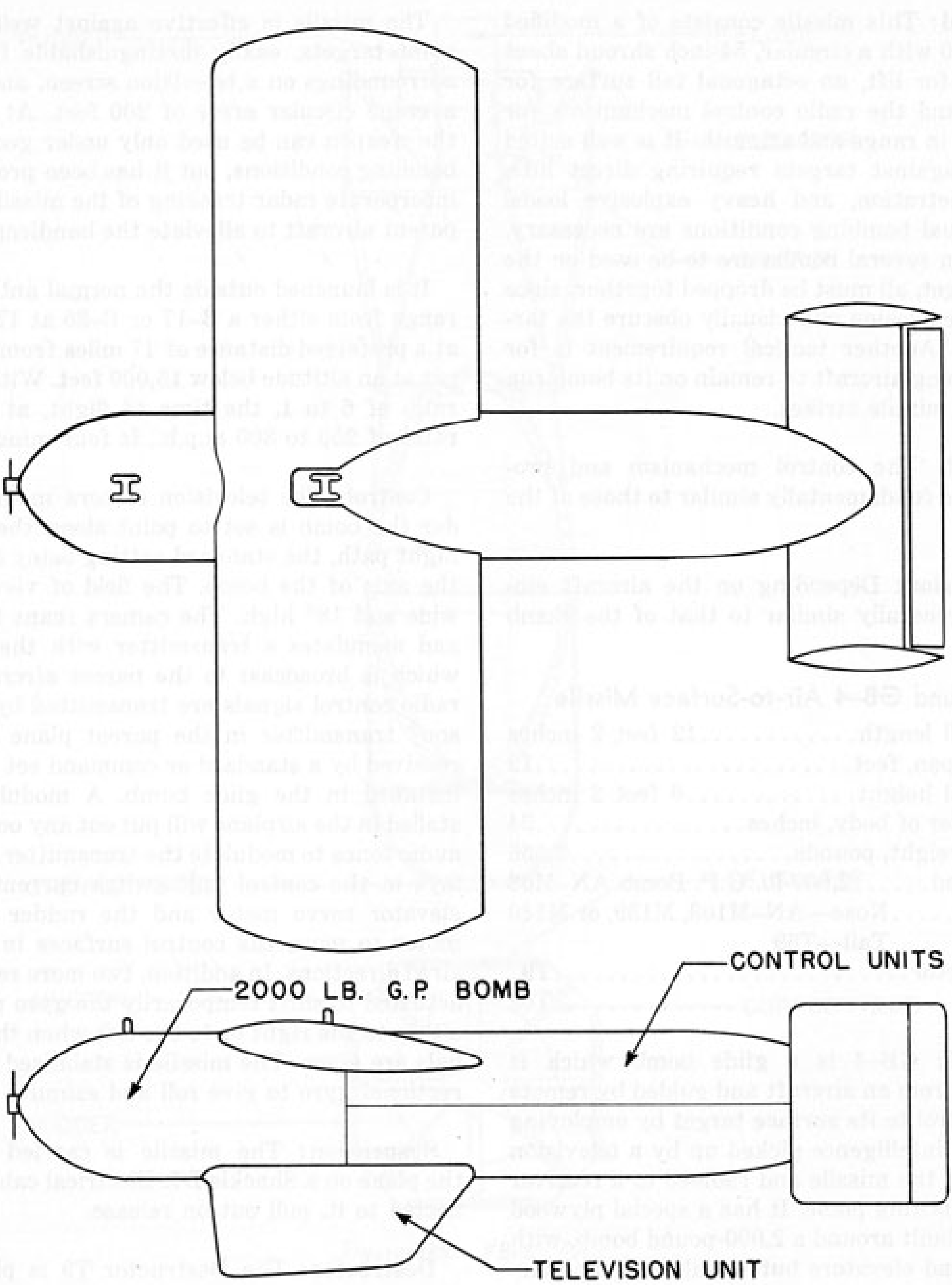


Figure 389. GB–4 Missile

2,500-pound GB–8 Air-to-Surface Missile

Over-all length. . . . . .11 feet 7 inches
Span. . . . . .12 feet 0 inches
Tail . . . . .4 feet 8 inches
Total weight, pounds. 2,555
Warhead. . . . .2,000-lb. G.P. Bomb AN–M66

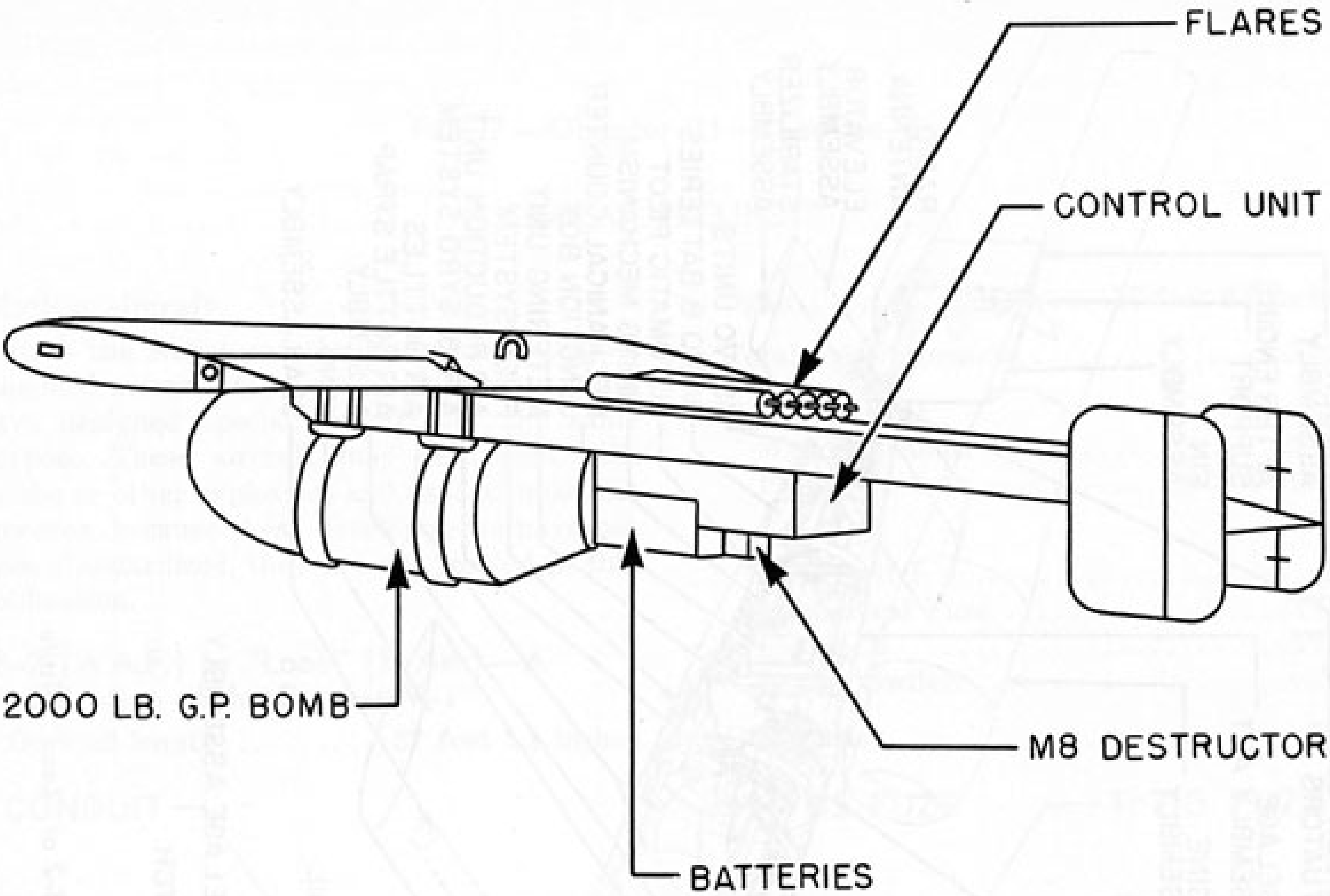


Figure 390. GB–8 Missile

Fuzing	Nose—AN–M103, M139, M140 Tail—M156
Destructor	M8
Fuze	M121
Flare	T3, T4

General: This is a radio-controlled glide bomb, with flare observation, designed for use on large installations. The wing is covered with plywood and is bolted to the boom assembly. The two spar booms are of solid poplar and have hinged bands attached to their front ends which secure the bomb to the frame. The elevator is covered with metal to prevent damage by the flares.

The GB–8 should be launched with the parent plane on a bomb run when the target is at bombardier's angle of 75°—which is still outside normal A.A. range at altitudes from 10,000 to 15,000 feet. It will glide at speeds varying about 6 to 1 depending on the elevator setting.

Control: The guiding system consists of a radio control link from the plane to the missile, servo connections to the control surfaces, gyro stabilization, and a flare panel of five Flares T3 and T4 (white and red) for observation.

Control surfaces are the ailerons on the wings, the elevator surface, and a single rudder on the left vertical stabilizer.

Destructor: The Destructor M8 mounted under and to the starboard of the control compartment is actuated, on impact, by the Fuze M121.

Suspension: The bomb is carried on the outside of the plane on a Shackle D7. A warm-up electrical cable pulls out on release.

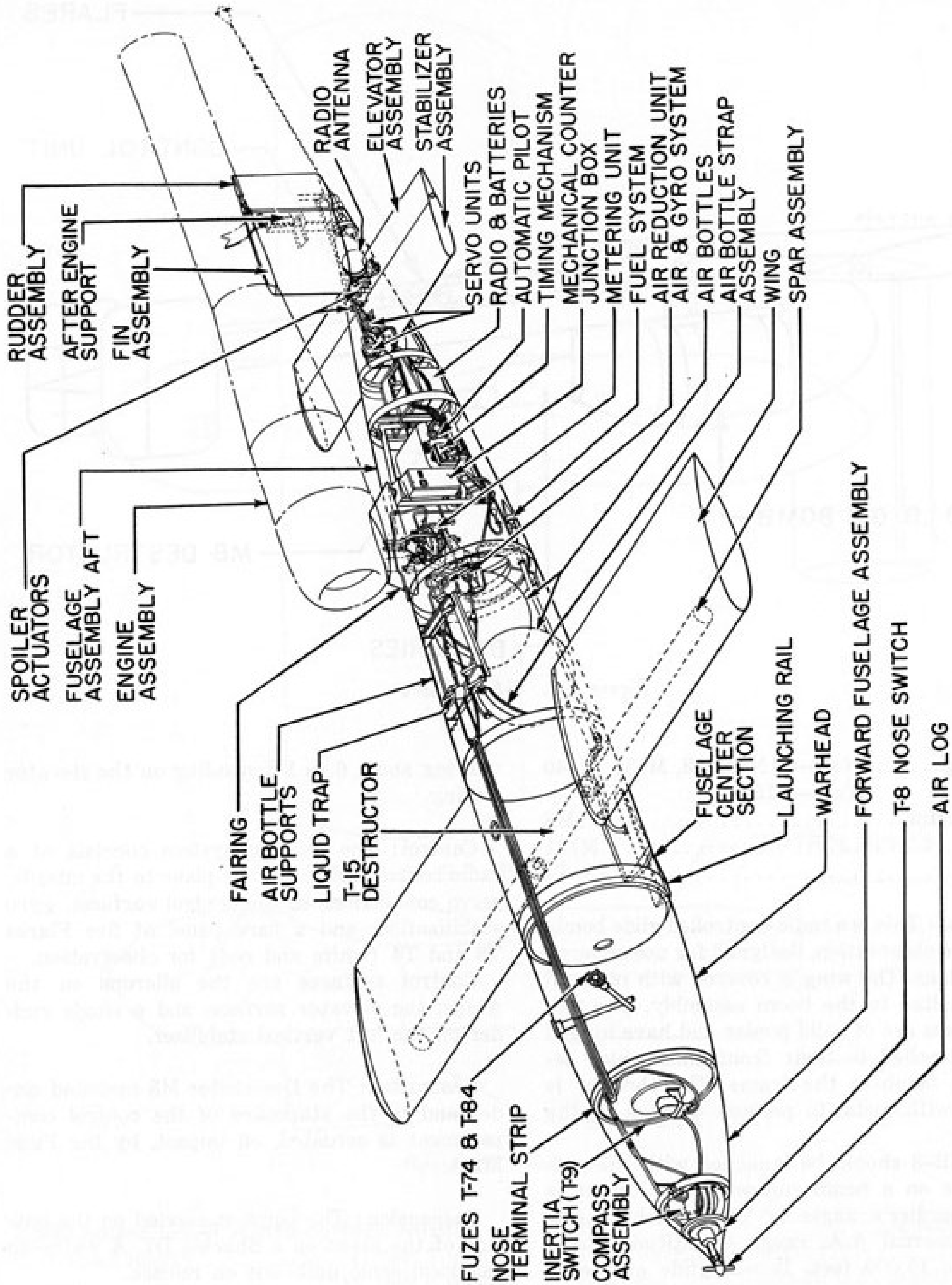


Figure 391. JB-2 or "Loon" Missile

SIMILAR PROJECTS

Pilotless aircraft

Both the Army and the Navy have adapted standard aircraft for remote radio control and have designed special aircraft for the same purpose. These aircraft may be loaded with bombs or other explosives and used as missiles; however, because these developments have not been standardized, they are not treated in this publication.

JB–2 (A.A.F.) or "Loon" (BuAer)—A Modification of the German V–1

Over-all length...........27 feet 1.1 inches

Span....................17 feet 8.1 inches

Total weight, pounds.................5,025

Warhead (T9)
- Weight, pounds 2,100
- Filling, pounds............1,875 Tritonal

Fuzing
- Nose Switch T8
- Mechanical Fuze T715
- Electrical T705
- Impact Switch T9

Destructor T15

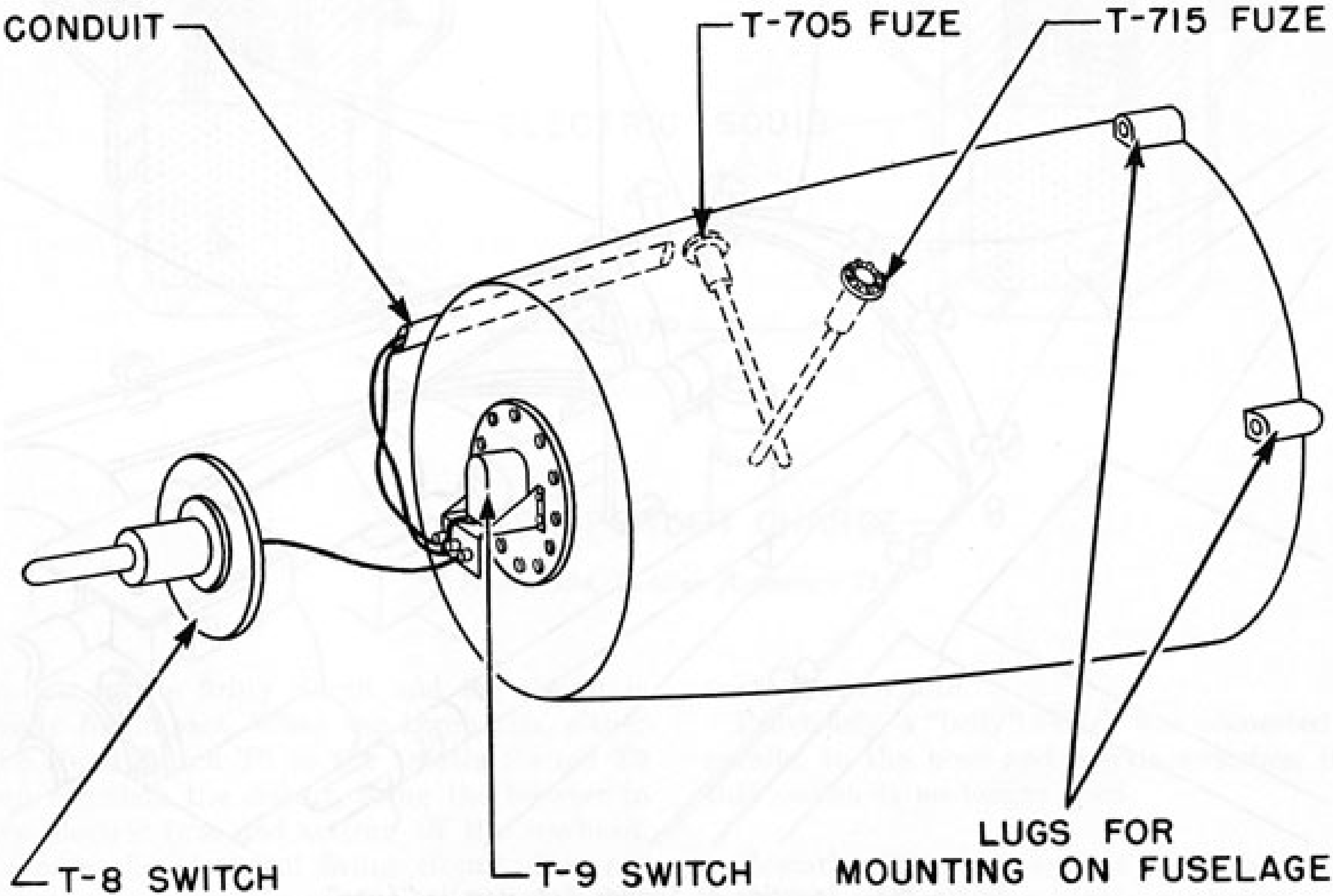


Figure 392. Warhead of "Loon", with Fuzes and Switches in Place

General: The JB–2 and "Loon" are copies of the German V–1, with modifications. As far as the ordnance components are concerned, the Army and Navy modifications are the same.

Warhead: The warhead is an aluminum-encased charge of Tritonal. The case is 3/8-inch thick and is bolted to the fuselage abaft the nose piece by four lugs.

Destructor T15: At the appropriate distance from the target, as determined by the Veeder Root Counter, an electrical contact is closed, which sets off the electric blasting caps in the Destructor T15, igniting the small charge and blasting apart the two junctions in the wing spar. The spar breaks; the wings come off; and the missile is forced into the dive toward its target.

Previously, the missile was put into its dive by the action of the Spoiler Actuators T1. These were small steel bullet-like cups filled with black powder and an electric squib. When activated by the Veeder Root Counter, they were fired down two vertical tubes in the tail section, releasing a spring-loaded knife arm which cut the rubber hoses from the servo motors to the controls; and, at the same time, the spring pulled the elevators down, putting the bomb into its dive.

Fuzing: The missile has an electrical fuze, an inertia switch, and a contact switch interlocked in an electric circuit with the Veeder Root Counter and battery. The electrical fuze closes its break in the circuit when the missile has traveled the distance set in the fuze gear train for arming (in the T705, 3 to 50 miles). When the bomb is at a prescribed distance set on the Veeder Root Counter, the counter closes its

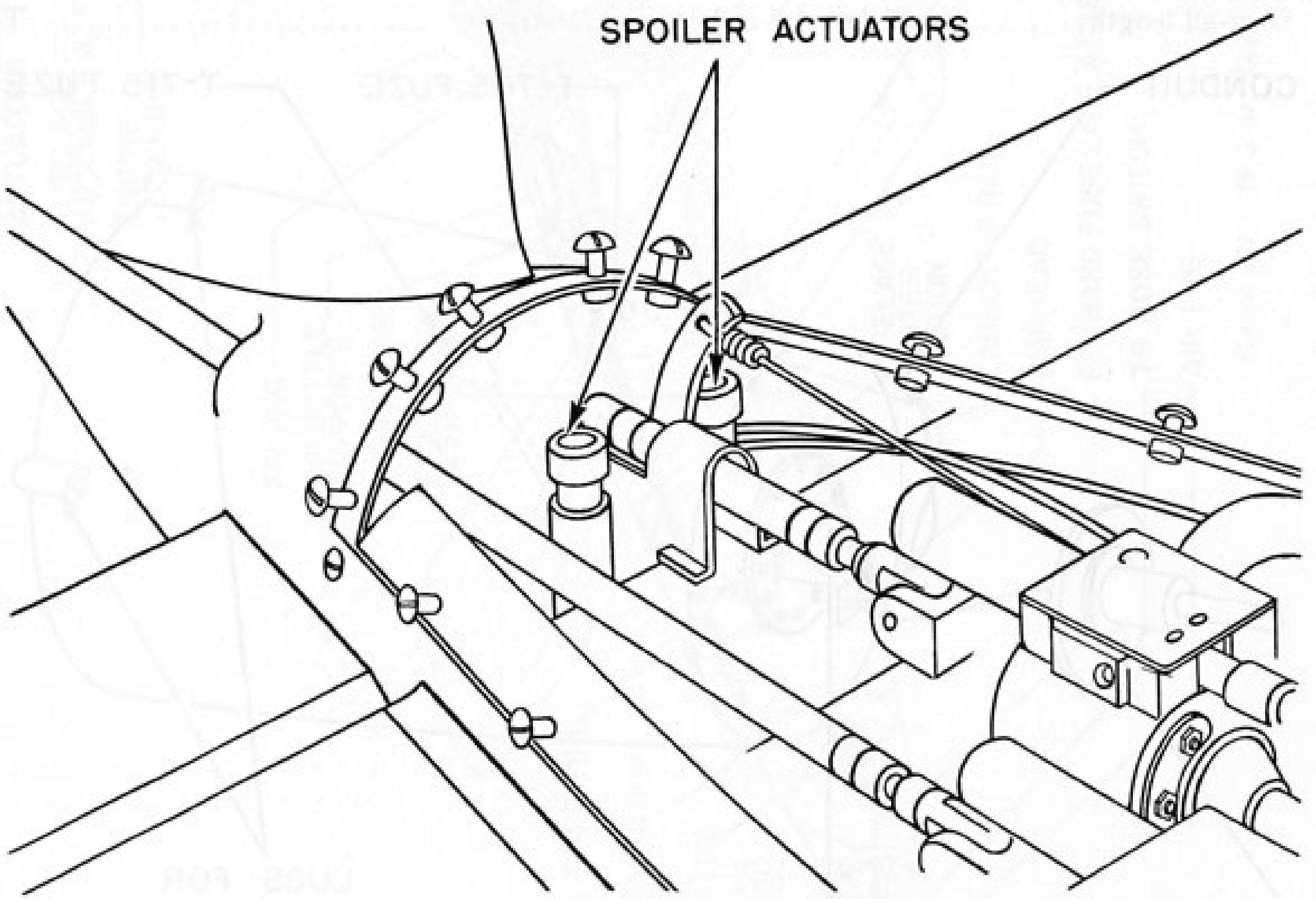


Figure 393. Location of Spoiler Actuators in "Loon"

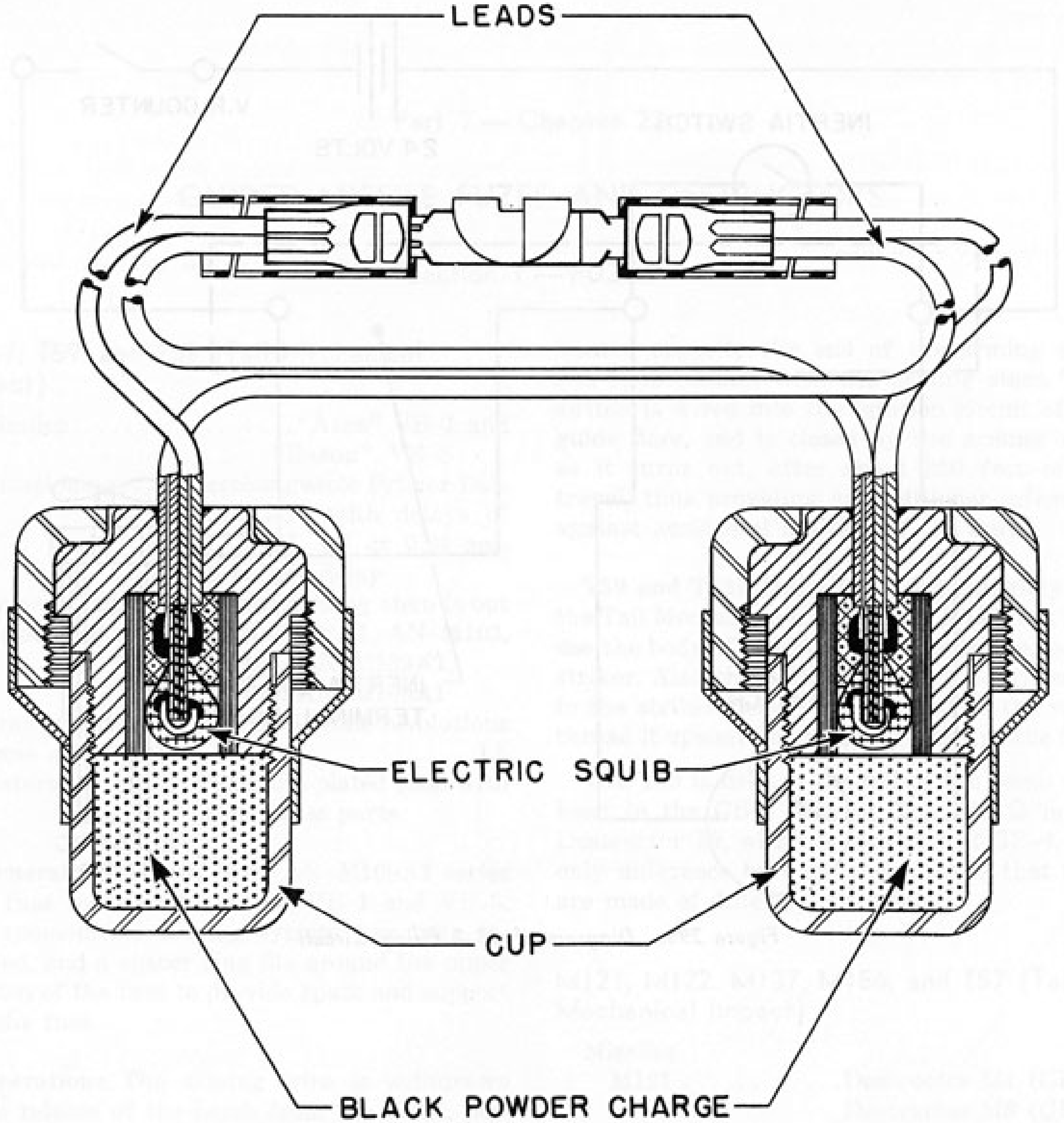


Figure 394. Spoiler Actuators T1

switch in the firing circuit and the circuit is ready for impact. When the bomb hits, either the Nose Switch T8 or the Inertia Switch T9 can complete the circuit, firing the booster in the electric fuze and setting off the warhead. In case the electrical firing circuit does not function properly, the mechanical fuze can detonate the warhead.

Previously, a "belly" switch was connected in parallel to the nose and inertia switches, but this switch is no longer used.

Remarks: This missile uses liquid oxygen as fuel, this oxygen being highly explosive.

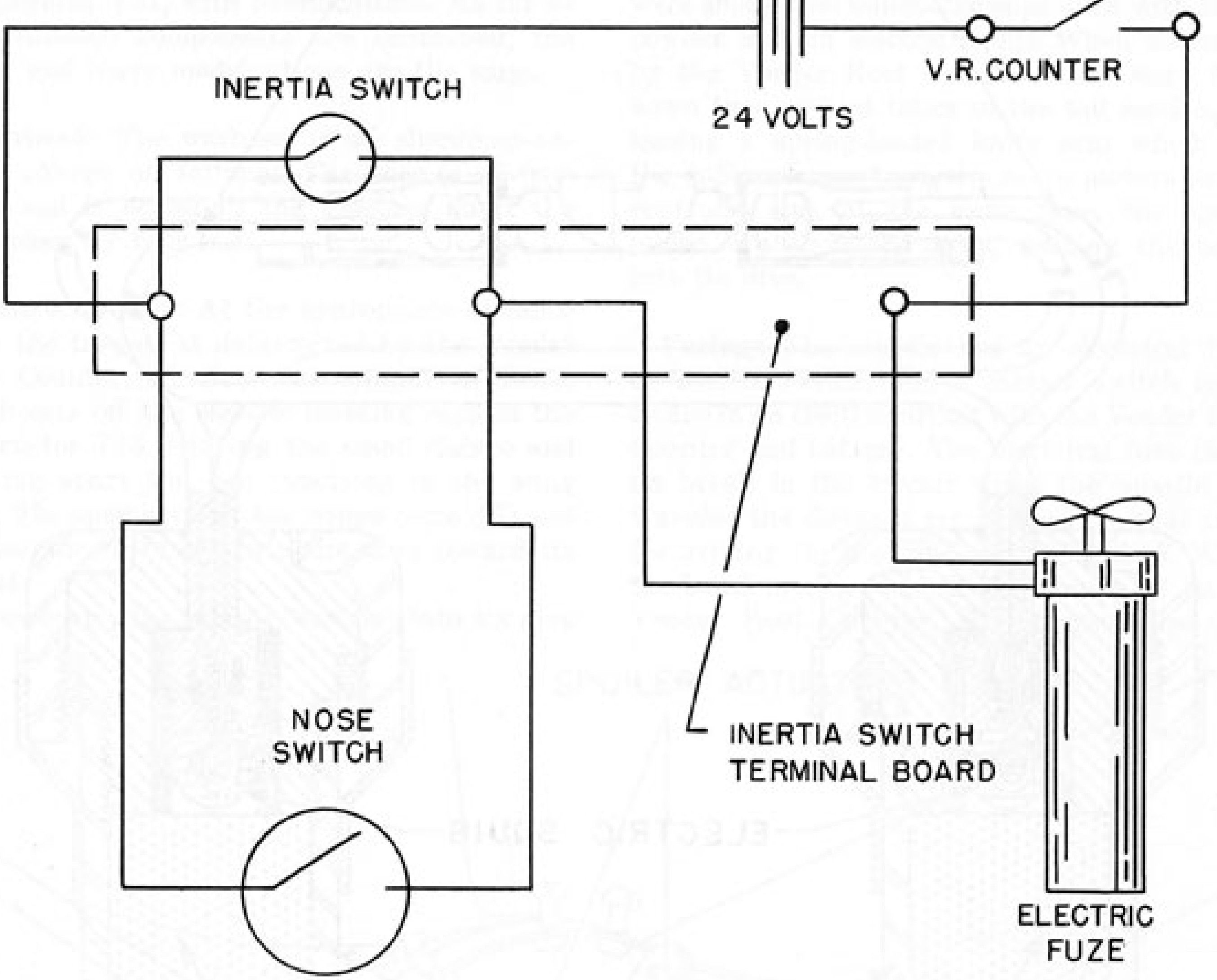


Figure 395. Diagram of JB-2 Firing Circuit

GUIDED MISSILE FUZES AND DESTRUCTORS

Section I — FUZES

M167, T59, and T62 (Tail Mechanical Impact)

Missiles . . . . "Azon" VB–1 and "Razon" VB–3
Functioning . . . . Interchangeable Primer Detonator M14 with delays of 0.01, 0.025, 0.1 or 0.24 second, or non-delay
Armed condition . . . When arming stem is out
Fuzes used with AN–M103A1, AN–M103, M139, AN–M139A1, M140, AN–M140A1
Arming data . . . . 1,200 vane revolutions
Vane span, inches 1.5
Material . . . . Cadmium-plated steel with some brass parts

General: The M167 is an AN–M100A1 series tail fuze modified to fit the VB–1 and VB–3. An anemometer arming system has been installed, and a spacer ring fits around the upper section of the fuze to provide space and support for the fuze.

Operation: The arming wire is withdrawn upon release of the bomb from the plane, permitting the spring-loaded arming pin to fly out and freeing the anemometer vanes for rotation. Rigidly attached to the vane assembly through a gear reduction system, the flexible shaft revolves with the vanes and turns a stem coupling which fits loosely to it. An arming stem riding in a slot in the coupling is threaded out of the firing plunger as the coupling revolves, arming the fuze. Upon impact, the plunger rides forward on its creep spring, hitting the Primer Detonator M14, initiating the explosive train.

A micro-switch mounted on the bracket is located opposite the end of the arming stem and is in contact with the arming stem. This switch is wired into the ignition circuit of the guide flare, and is closed by the arming stem as it turns out, after about 350 feet of air travel, thus providing an additional safeguard against accidental ignition of the flare.

T59 and T62: These fuzes are generally like the Tail Mechanical Impact Fuze M167, but they use the body of the Fuze M112, with the cocked striker. Also, the arming spindle is not threaded in the striker sleeve; it slides out as the vanes thread it upward in the gear section of the fuze.

The T59 is used in the tail of the bomb warhead in the GB–4 Missile. The T62 is in the Destructor T9, which is also part of GB–4. The only difference between the fuzes is that they are made of different materials.

M121, M122, M137, M156, and T57 (Tail Mechanical Impact)

Missiles
M121 . . . . Destructor M4 (GB–4) Destructor M8 (GB–8)
M122 . . . . GB–1 (Cancelled)
M137 . . . . Destructor M5 (GT–1) (Cancelled)
M156 . . . . GB–8
T57 . . . . Undetermined
Functioning
M121 . . . . . . Non-delay—Primer Detonator M27
M122 . . . . . . 4- to 5-sec. delay—Primer Detonator M16A1
M137 . . . . . . 4- to 5-sec. delay—Primer Detonator M16A1

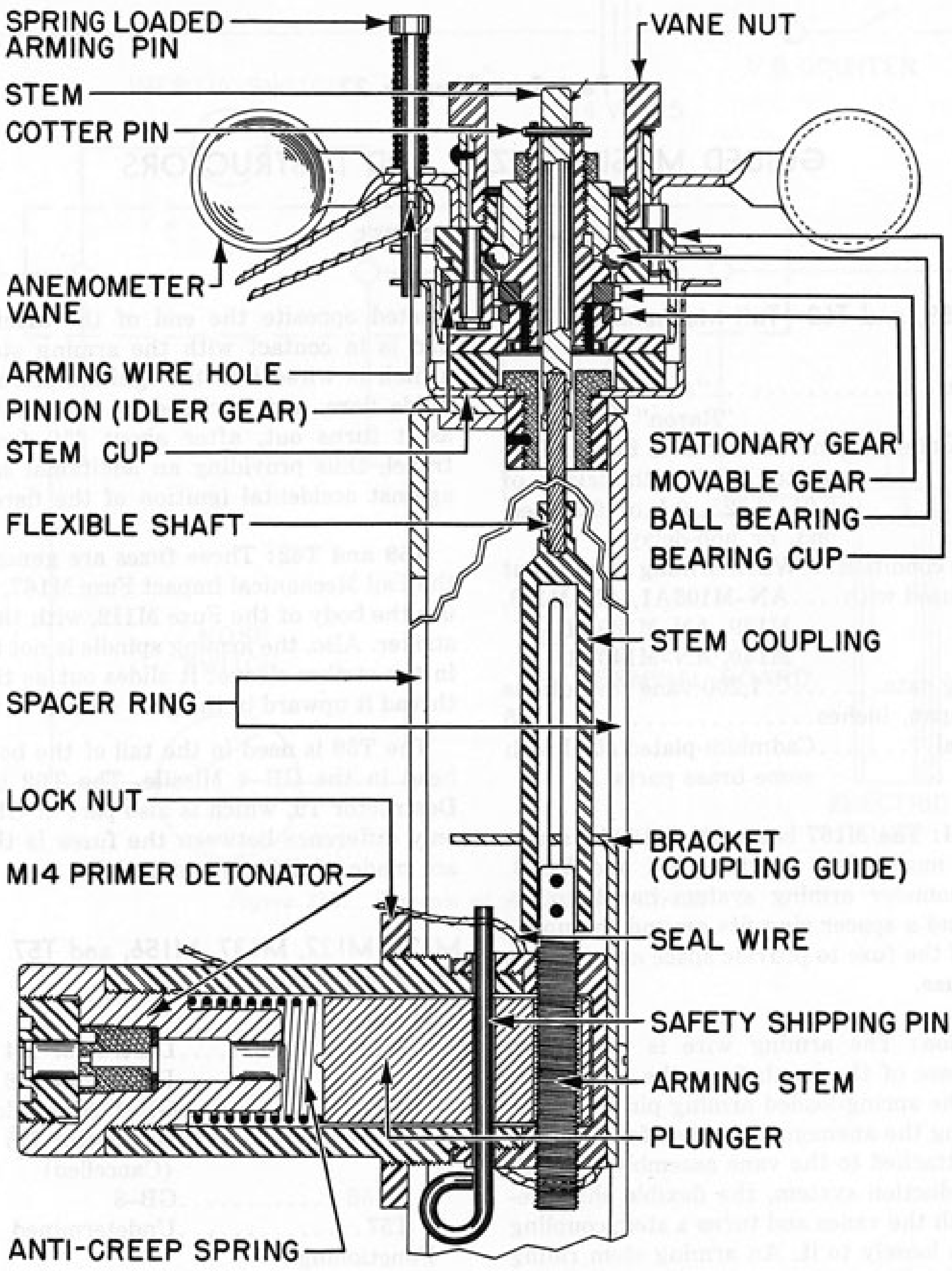


Figure 396. Tail Fuze M167

M156 . . . . . . 4- to 5-sec. delay—Primer Detonator M16A1
T57. . . . . Non-delay

Length, inches
M121 . . . . 9.6
M122 . . . . 16.6

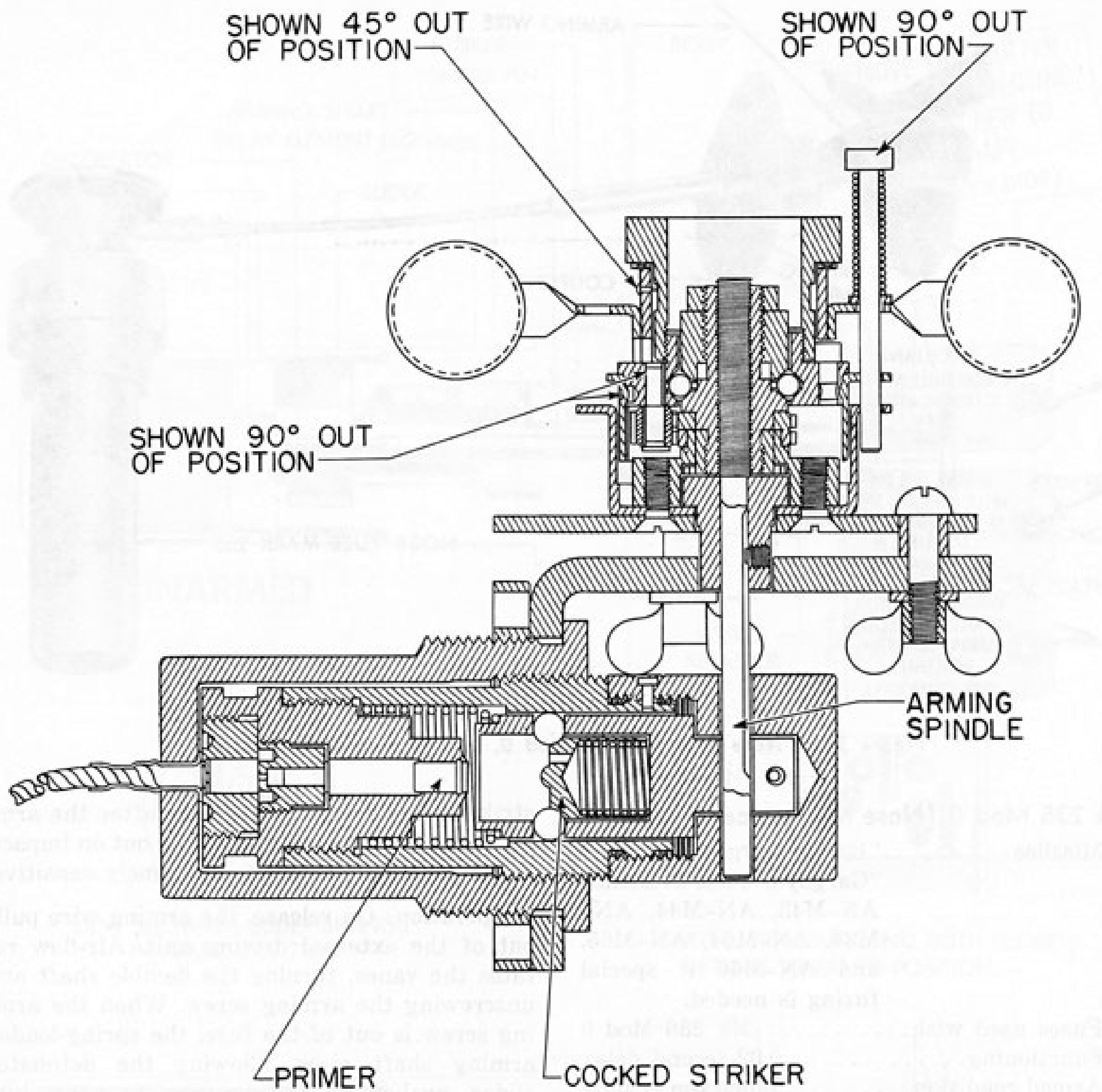


Figure 397. Tail Fuze T62

M137 . . . . 9.6
M156 . . . . 12.6
Arming data. . . . . 150 to 170 vane revolutions

General: These fuzes are exactly like the M115 series, except for the primer detonator combinations and some differences in materials. The construction and operation are the same.

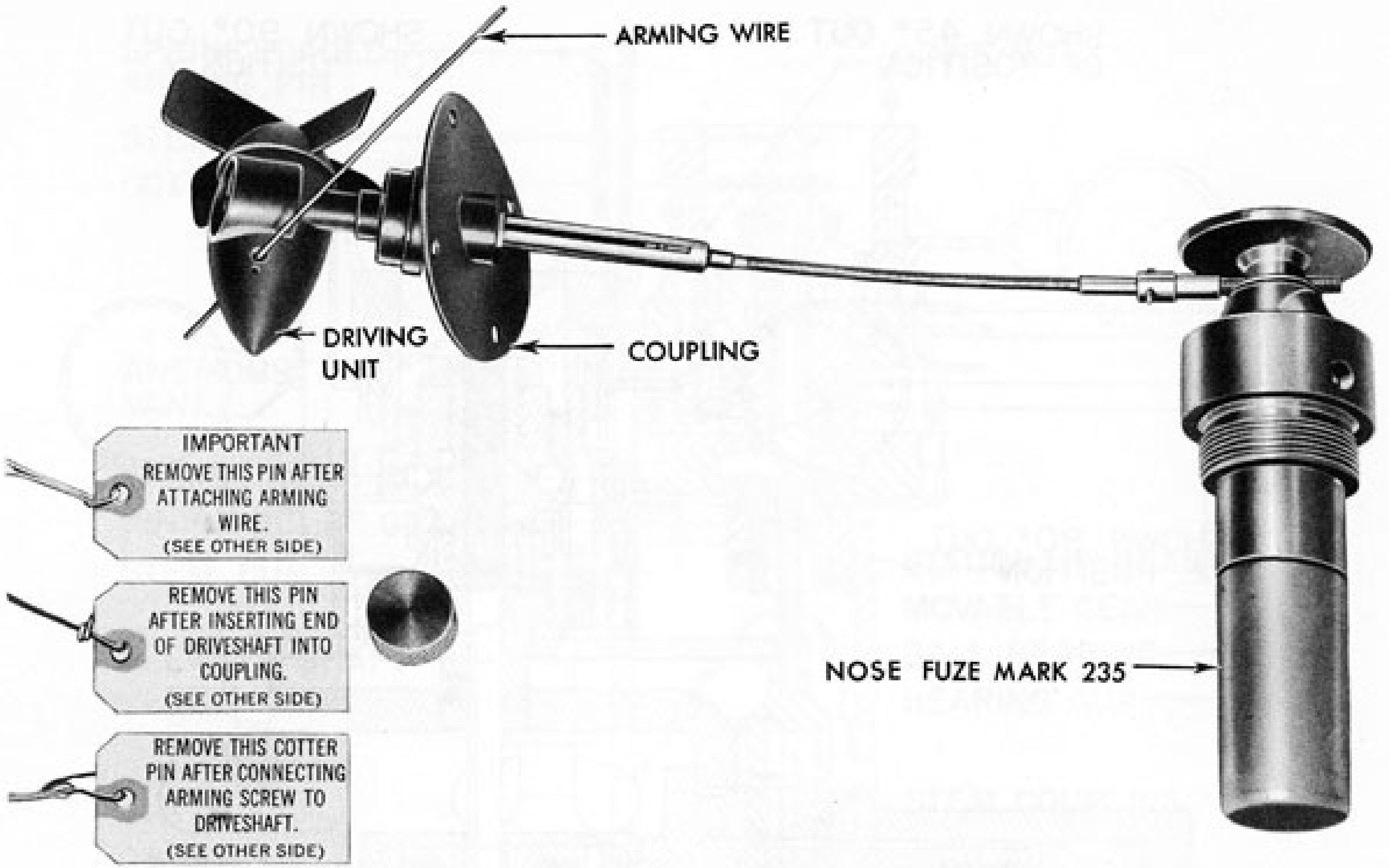


Figure 398. Nose Fuze Mk 235 Mod 0, with Driving Unit Attached

Mk 235 Mod 0 (Nose Mechanical Impact)

Missiles.......... "Bat", "Gorgon IIC", and "Gargoyle"; will fit Bombs AN–M43, AN–M44, AN–M34, AN–M64, AN–M65, and AN–M66 if special fuzing is needed.

Fuzes used with............ Mk 236 Mod 0

Functioning.............. 0.02-second delay

Armed condition.......... When the arming screw is out

Arming data............ 2,500 to 3,000 feet air travel

General: Another of the elbow-type fuzes, the Mk 235's fuze body is connected by a flexible coupling to the external driving unit. The body part resembles somewhat the Nose Mechanical Impact Fuze AN–M103 with its sliding detonator shutter. However, in this fuze there is only the delay firing train. A snap ring in a groove on the neck of striker holds the striker away from the hammer after the arming screw is out, until it is forced out on impact. When armed, this fuze is extremely sensitive.

Operation: On release, the arming wire pulls out of the external driving unit. Air-flow rotates the vanes, turning the flexible shaft and unscrewing the arming screw. When the arming screw is out of the fuze, the spring-loaded arming shaft rises, allowing the detonator slider, pushed by two springs, to move into position under the delay element and above the booster lead-in. A detent then locks the slider in place. On impact, the nose plate and striker are forced in, expanding the snap ring and forcing the firing hammer to drive the firing pin into the delay primer, setting off the delay and explosive train.

Remarks: The detonator has an expansion hole above it in the unarmed position, so that accidental detonation cannot set off the tetryl booster.

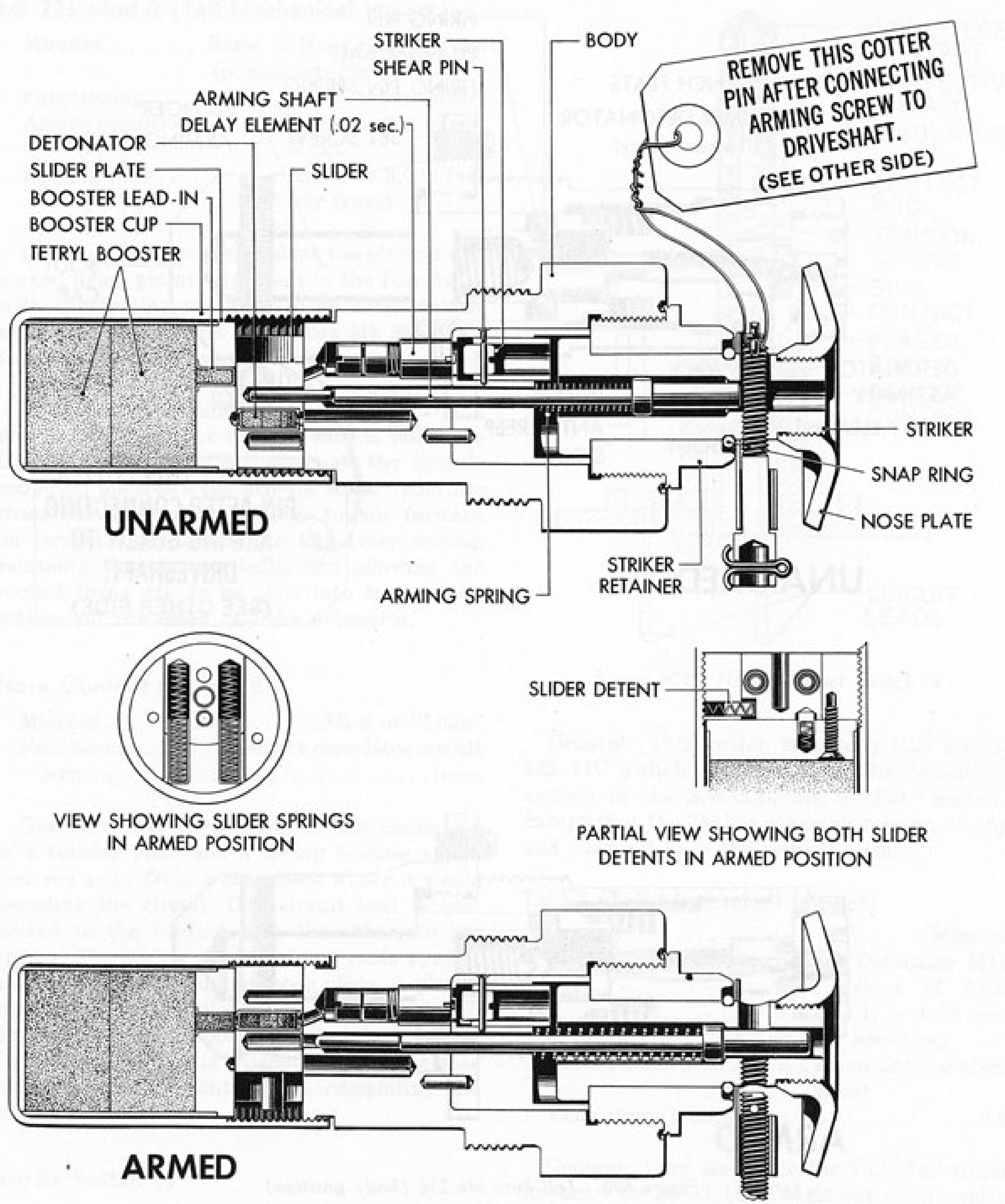


Figure 399. Nose Fuze Mk 235 (body position)

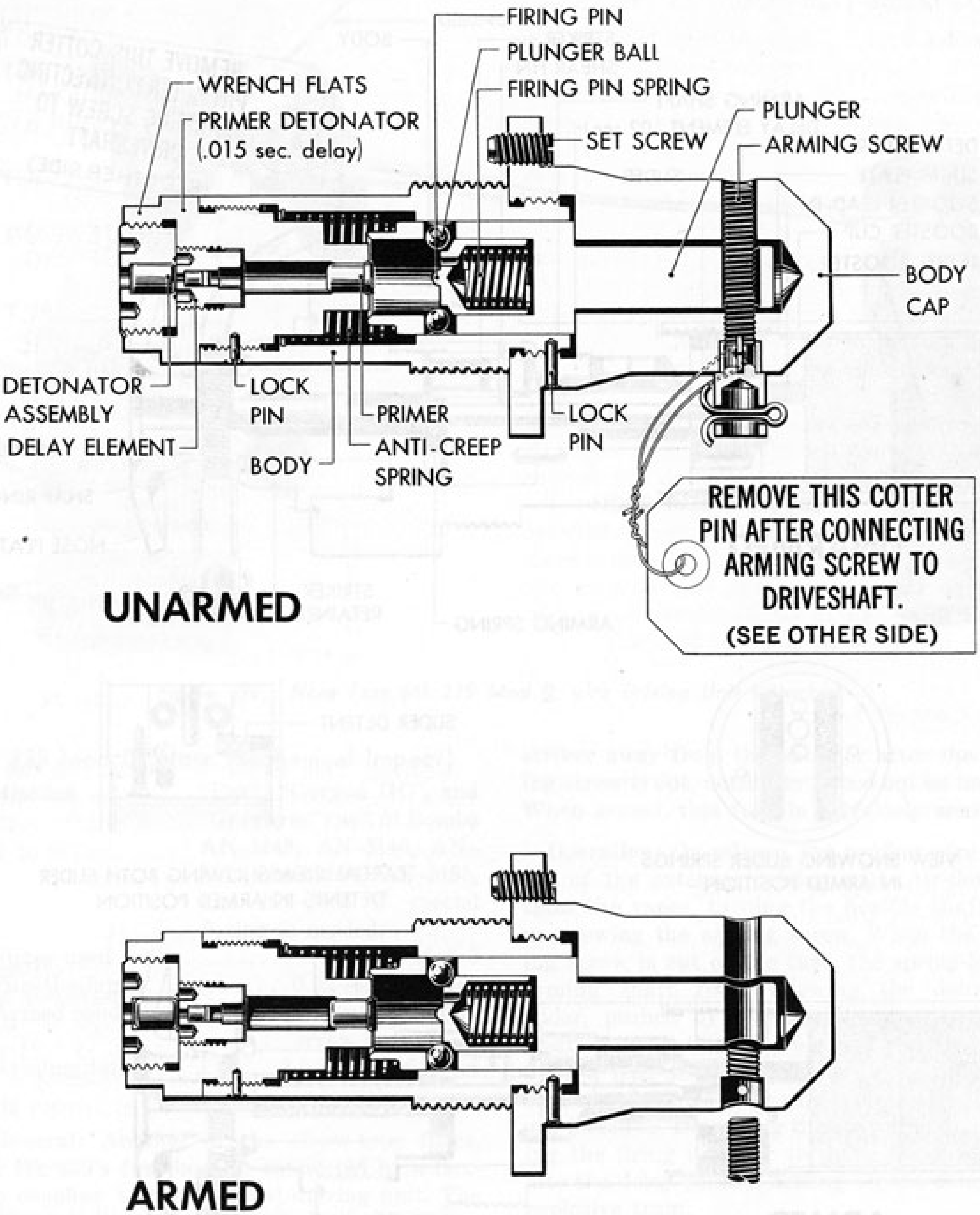


Figure 400. Tail Fuze Mk 236 (body position)

Mk 236 Mod 0 (Tail Mechanical Impact)

Missiles.........Same as Nose Fuze Mk 235 (companion fuzes)
Functioning.............0.015-second delay
Armed condition........When arming screw is out
Arming data.............2,500 to 3,000 feet air travel

General: This design employs the plunger and cocked firing pin arrangement in the fuze body, with the arming assembly in an exterior unit similar to that of the Nose Fuze Mk 235. This fuze is extremely sensitive when armed.

Operation: The vanes of the external arming unit rotate when the arming wire is pulled on launching. This rotation, through the flexible coupling, unscrews the arming screw from the fuze. The plunger is now free to ride forward on impact, overcoming the anti-creep spring, releasing the plunger balls, and allowing the cocked firing pin to be shot into the primer, setting off the delay and the detonator.

Nose Contact Switch T8

Missiles...................JB–2 or "Loon"
Functioning........Impact completes circuit
Arming.........................None

General: This is a simple switch consisting of a tubular piece and a spring holding a contact rod away from a nose piece where it would complete the circuit. One circuit lead is connected to the contact rod; the other, to the spring. The spring's forward end rests against a copper-plated aluminum nose piece. A plastic tube insulates this piece from the contact rod. The contact rod is bolted to the plastic base. On impact, the tube is crushed, forcing the nose piece against the contact rod, completing the circuit.

Inertia Switch T9

Missiles...................JB–2 or "Loon"
Functioning...."All-ways action" on impact ($10g$) completes circuit

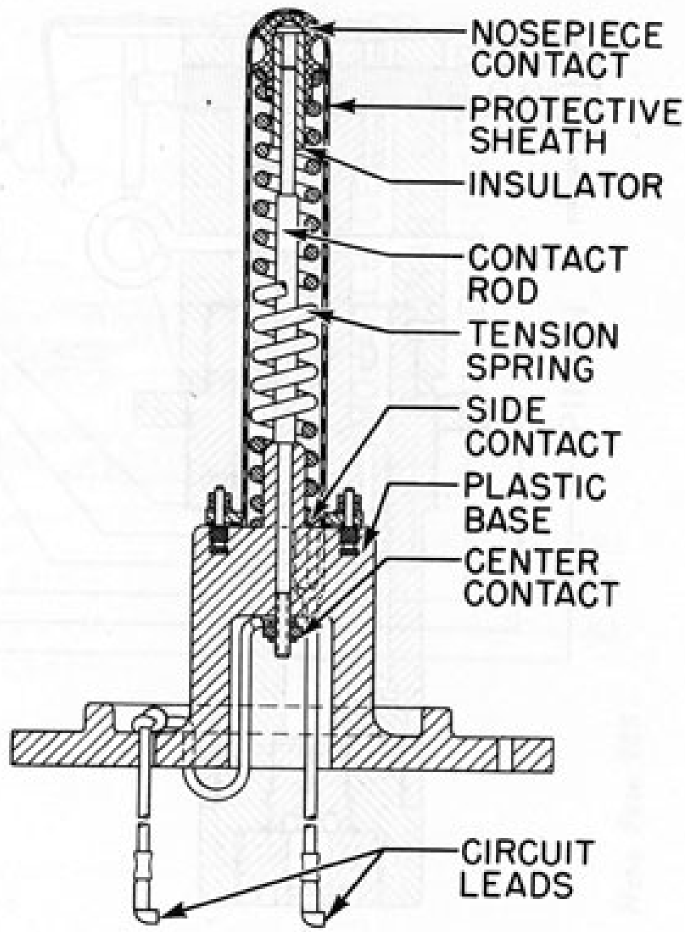


Figure 401. Nose Contact Switch T8

General: This switch is exactly like the S–122–11G switch described with the demolition system in the S.W.O.D. Mk 9 "Bat" section, except that the T9 has a spring tension of $10g$ and does not have the arming stem.

T65E2 (Tail Mechanical Impact)

Use...............................Missiles
Functioning.........Primer Detonator M14 with delays of 0.01, 0.025, 0.1, or 0.24 second, or non-delay
Armed condition........When arming stem is out
Vane span, inches.....................5.2

General: Very similar to the Tail Mechanical Impact Fuze M167, the T65E2 has a differently shaped plunger and is mounted by a different bracket. It uses the M100 type vanes and reduction gear arming, is of the "elbow" design

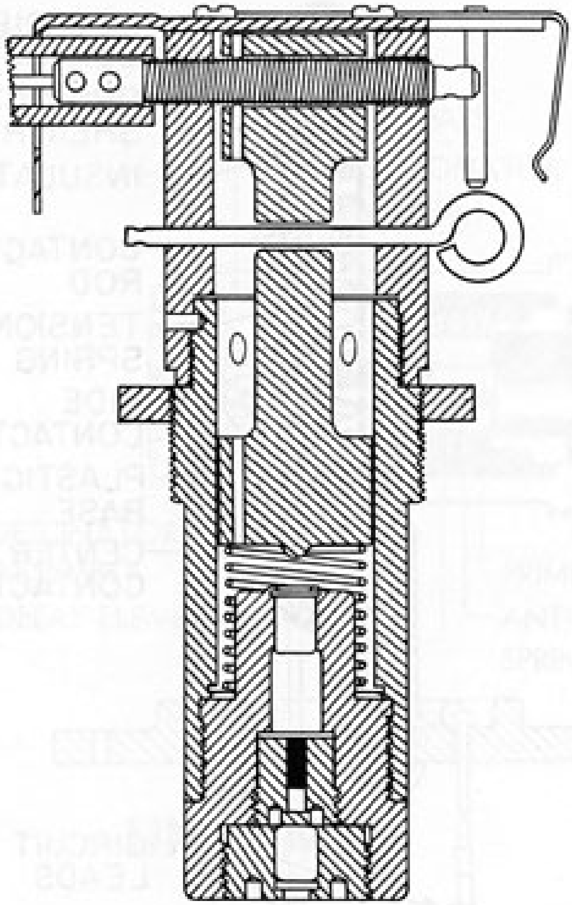


Figure 402. Tail Fuze T65E2

because of its projected use in guided missiles, and employs the Primer Detonator M14 with the interchangeable delays.

T85 (Nose Mechanical Impact)

Missiles ...."Felix"
Functioning.........Instantaneous or 0.1-second delay
Armed condition......When arming spindle is out
Arming data.........1,200 vane revolutions

General: This is an "elbow"-shaped fuze for use in guided missiles. At present it is used only in the nose of "Felix" VB–6. It is essentially a Nose Mechanical Impact Fuze AN–M103 connected to the remote windmill arming vanes by a flexible cable. The vane and gear assembly is the same as that used on the Tail Mechanical Impact Fuze M167. The fuze proper is like the AN–M103, except that it does not have the vane cap, safety discs, or arming screw.

T715 and T84 Series (Athwartship Mechanical Impact)

Missiles....................JB–2 or "Loon"
Functioning..........All-ways-action, long-delay arming
Arming data....T715 can be set 4 to 45 miles
T84E1—4 to 5 miles
T84E2—12 to 15 miles
T84E3—25 to 30 miles
T84E4—40 to 50 miles

General: These are the mechanical fuzes of American design or the JB–2 or "Loon" missile. The T84 series was replaced by the T715, but neither fuze is now on order. The fuzes are similar in construction, except that the T715 allows for varying the arming time by an adjustable setting pin, whereas, in the T84 series, each modification has a fixed setting. Both fuzes have the heavy brass inertia weight and tapered firing-pin housings, so that slight sidewise impact, when armed, will release the cocked firing pin. The drive shaft from the vanes to the gear system is mounted in ball bearings. The locating clip is an assembly feature, to hold the inertia housing in place.

On the T715, arming time is set by varying the depth at which the setting pin is screwed into a drive dog. A special key is supplied with the fuze to insure accurate settings. The setting pin is slowly threaded out as the gears turn it, and, when it comes out of the dog, the fuze begins to arm itself. Following is a table of settings:

Special Screw-Driver Depth (Inches)	Arming Distance (Miles)
0.03	4
0.10	11
0.20	23
0.30	34
0.40	45

Operation: Vane rotation through the reduction gear train turns a drive disc, at the same time rotating a threaded gear and backing the threaded setting pin out of its drive dog. When the setting pin comes out, a spring shoves the dog toward the drive disc, latching the shaft

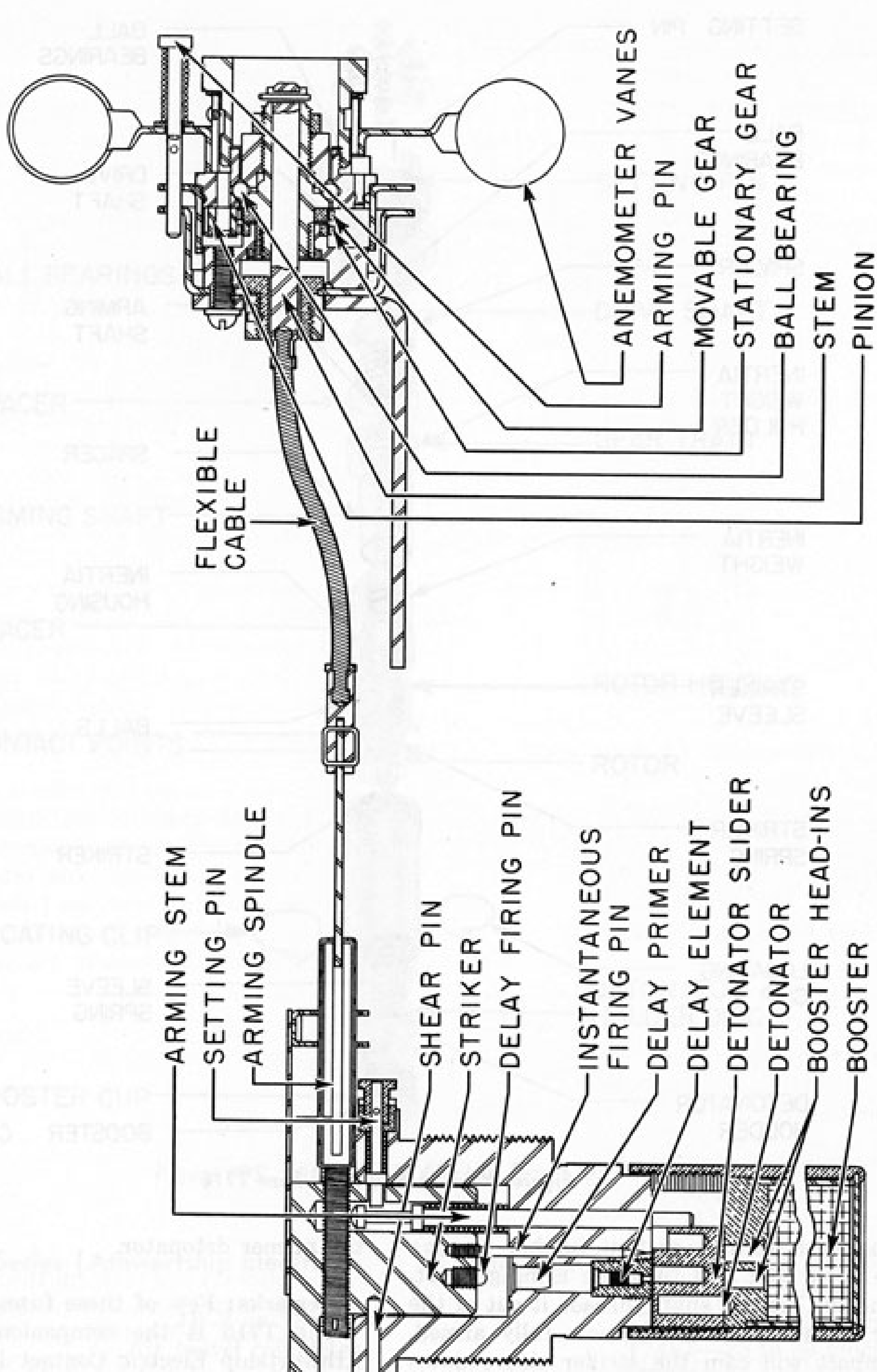


Figure 403. Nose Fuze T85

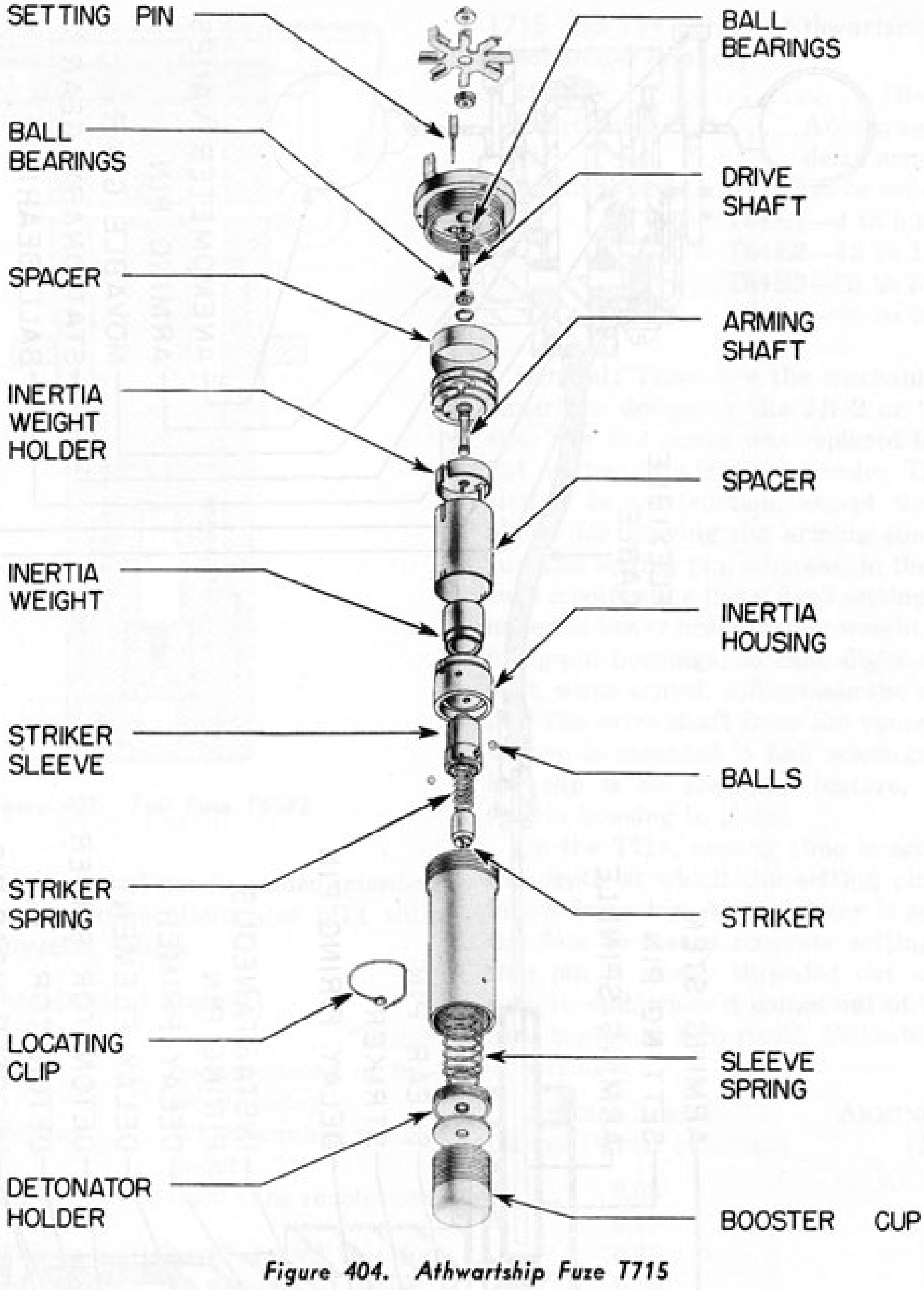


Figure 404. Athwartship Fuze T715

hub to the drive disc, so that further turning of the drive disc will turn the arming shaft. Turning the arming shaft threads it out of the striker sleeve. The fuze is now fully armed, and impact will cam the striker sleeve down against the sleeve spring, freeing the balls and allowing the cocked firing pin to be shot into the primer detonator.

Remarks: Few of these fuzes were made.

The T715 is the companion fuze for the Athwartship Electric Contact Fuze T705; the T84, for the Athwartship Electric Contact Fuze T74 or corresponding modification.

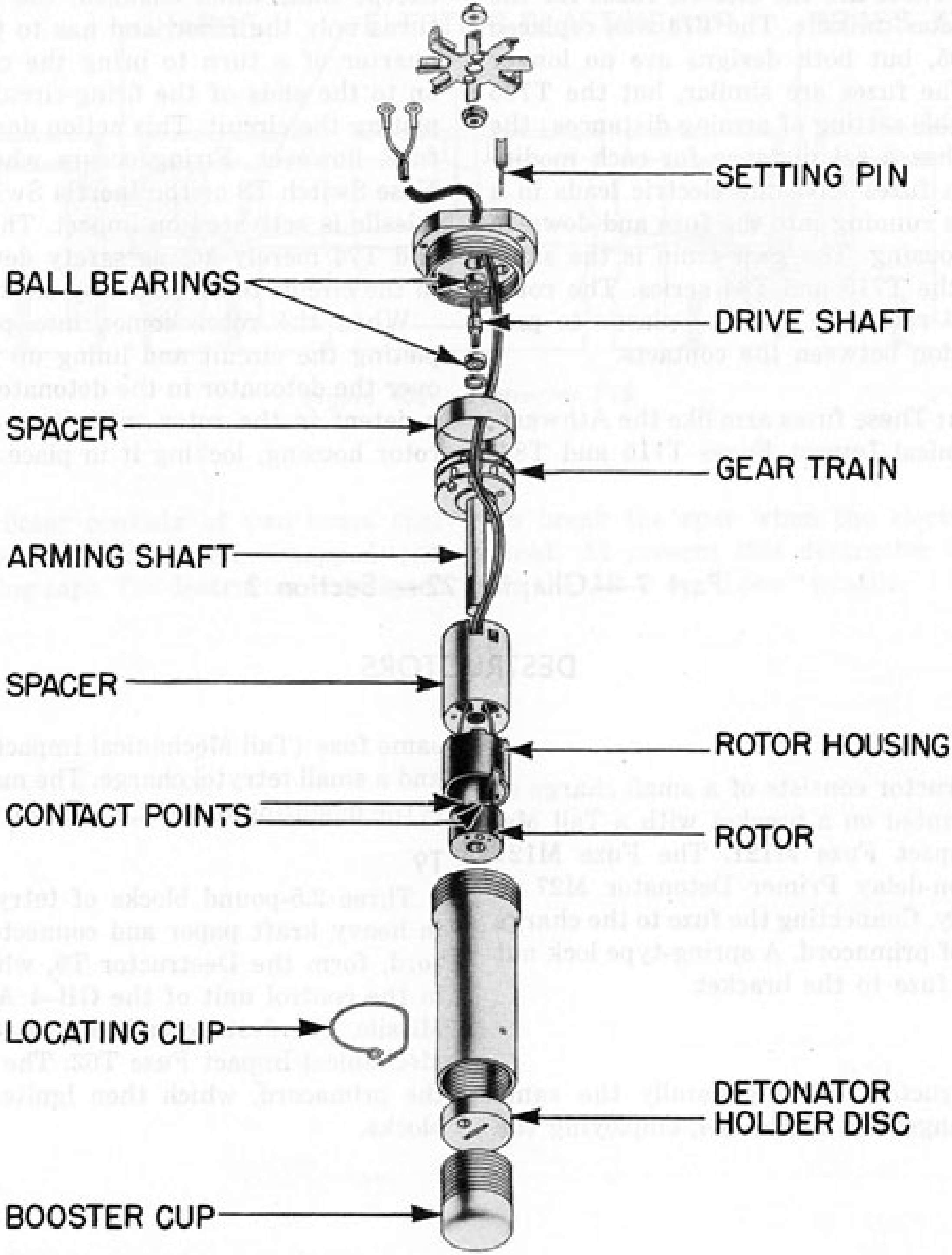


Figure 405. Athwartship Electric Fuze T705

T705 and T74 Series (Athwartship Electric Contact)

Missiles....................JB–2 or "Loon"
Functioning...........Air travel completes electric circuit
Arming data....T705 can be set 4 to 45 miles
T74E1—4 to 5 miles
T74E2—12 to 15 miles
T74E3—25 to 30 miles
T74E4—40 to 50 miles

General: These are the electric fuzes for the JB–2 or "Loon" missile. The T74 was replaced by the T705, but both designs are no longer on order. The fuzes are similar, but the T705 allows variable setting of arming distances; the T74 series has a set distance for each modification. Both fuzes have the electric leads in a rubber cable running into the fuze and down to the rotor housing. The gear train is the same as that in the T715 and T84 series. The rotor housing and rotor are made of plastic to provide insulation between the contacts.

Operation: These fuzes arm like the Athwartship Mechanical Impact Fuzes T715 and T84, except that, when engaged, the arming shaft turns only the rotor, and has to turn it only a quarter of a turn to bring the contact points on to the ends of the firing-circuit leads, completing the circuit. This action does not fire the fuze, however. Firing occurs when either the Nose Switch T8 or the Inertia Switch T9 in the missile is activated on impact. The Fuzes T705 and T74 merely act as safety devices—breaks in the circuit to be closed by air-travel arming.

When the rotor comes into position, completing the circuit and lining up its flash hole over the detonator in the detonator-holder disc, a detent in the rotor snaps into a hole in the rotor housing, locking it in place.

Part 7 — Chapter 22 — Section 2

DESTRUCTORS

M4

This destructor consists of a small charge of tetrytol mounted on a bracket with a Tail Mechanical Impact Fuze M121. The Fuze M121 uses the non-delay Primer Detonator M27 in this assembly. Connecting the fuze to the charge is a length of primacord. A spring-type lock nut secures the fuze to the bracket.

M8

The Destructor M8 is generally the same kind of arrangement as the M4, employing the same fuze (Tail Mechanical Impact Fuze M121) and a small tetrytol charge. The main difference is the mounting bracket, as shown in figure 407.

T9

Three 2.5-pound blocks of tetrytol, wrapped in heavy kraft paper and connected by primacord, form the Destructor T9, which is placed in the control unit of the GB–4 Air-to-Surface Missile. The destructor is activated by the Tail Mechanical Impact Fuze T62. The fuze sets off the primacord, which then ignites the charge blocks.

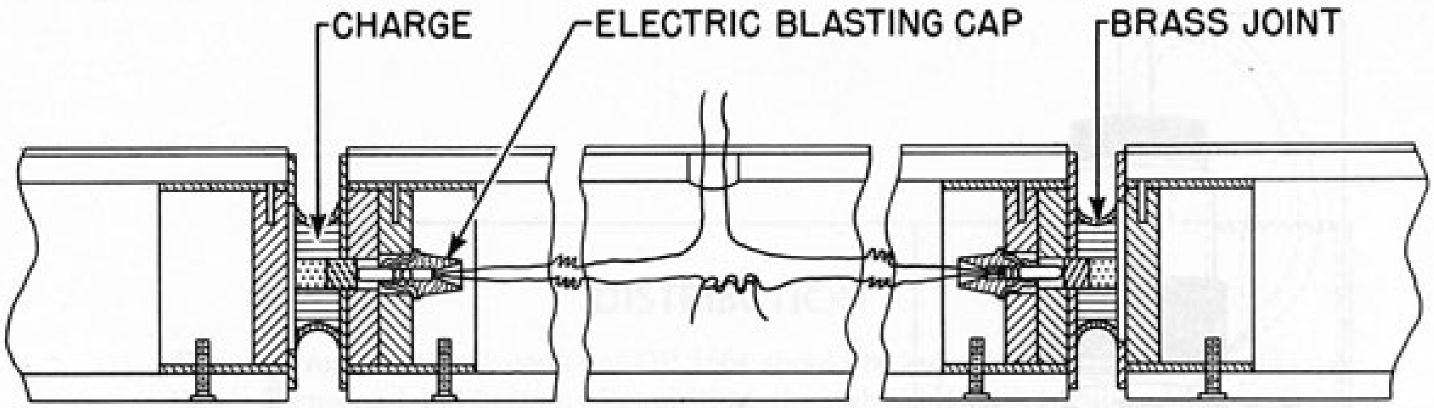


Figure 406. Destructor T15

T15

This destructor consists of two brass spar joints filled with an explosive and capped with electric blasting caps. The destructor is designed to break the spar when the electric caps are fired. At present this destructor is used only in the JB–2 or "Loon" missile.

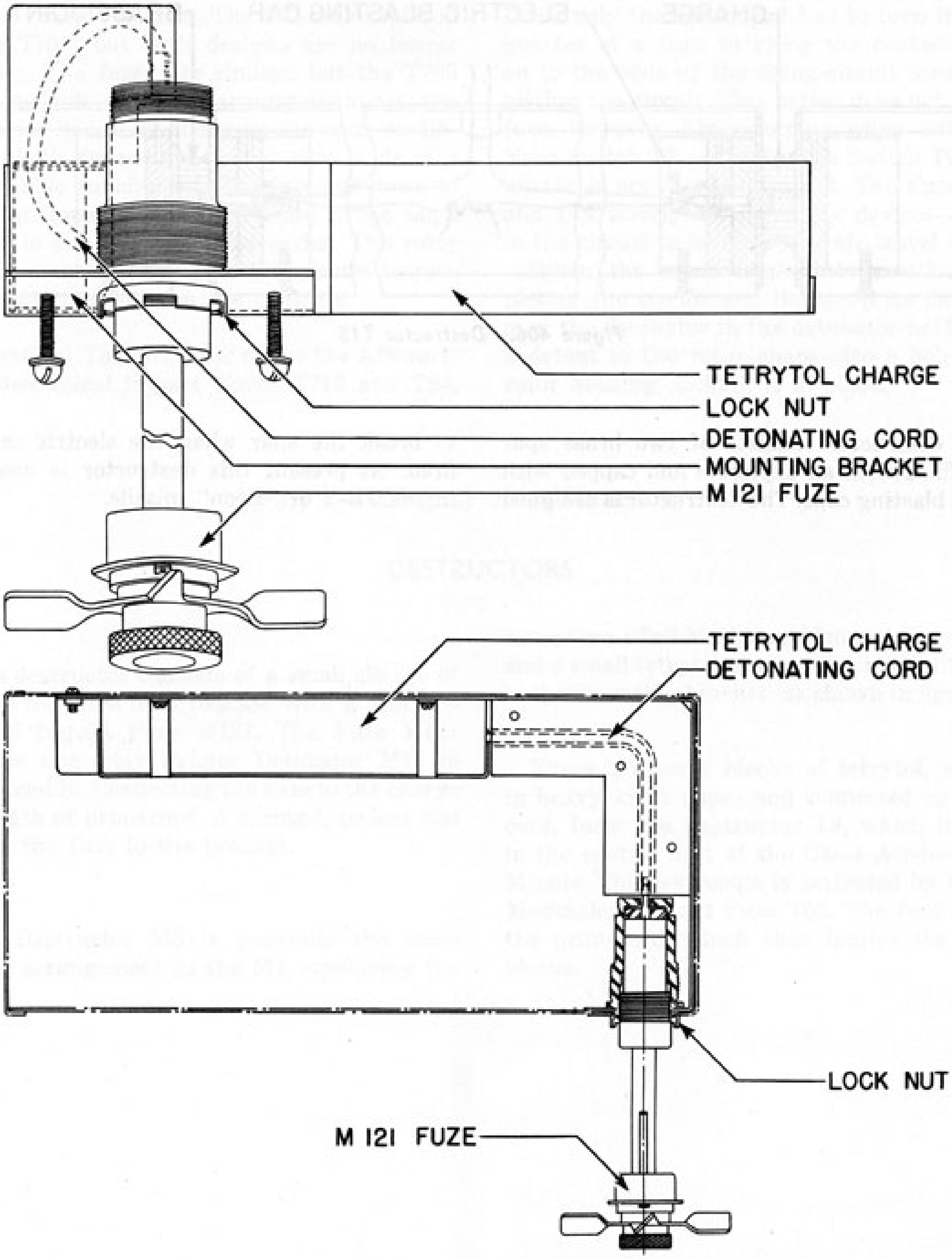


Figure 407. Destructors M4 and M8

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